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CLASSIFICATION ABILITIES AS RELATED TO INSTRUCTION AND
ACHIEVEMENT IN EARLY ADOLESCENCE.
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THIS IS THE REPORT OF A PILOT INVESTIGATION DESIGNED (1) TO STUDY THE ABILITY OF CHILDREN IN REGULAR CLASSROOM SETTINGS TO ORGANIZE INFORMATION THEY POSSESS IN WAYS SUGGESTED BY TWO DIMENSIONS OF THE GUILFORD STRUCTURE OF INTELLECT MODEL, AND (2) TO EVALUATE THE FEASIBILITY AND DESIRABILITY OF MAKING PARTICIPATION IN THE STUDY, IN DATA COLLECTION AND ANALYSIS, AN INTEGRAL PART OF THE PROFESSIONAL EDUCATION OF POTENTIAL TEACHERS. SUBJECTS WERE PUPILS ENROLLED IN TWO SECTIONS OF EIGHT-GRADE ENGLISH. THE GENERAL DESIGN FOR THE STUDY CONSISTED OF ADMINISTERING CLASSIFICATION TASKS, AND SCORING THE INSTRUMENTS FOR QUANTITY, ACCURACY, AND QUALITY WHERE APPROPRIATE. THE RESULTS INDICATE THAT IT IS PRACTICAL TO EXPECT TEACHERS TO BE ABLE TO ELICIT CLASSIFICATION BEHAVIOR FROM THEIR STUDENTS, AND THAT IT IS DESIRABLE FOR THEM TO DO SO. CLASSIFICATION ABILITY WAS FOUND RELATED TO ACHIEVEMENT IN SUCH SEEMINGLY DIVERSE SUBJECT MATTERS AS MATHEMATICS AND HISTORY AND IS RELATED, ALSO, TO VOCABULARY AND READING COMPREHENSION. THE FINDINGS LEND SUPPORT TO THE USE OF THE SEVERAL OPERATIONS IN STIMULATING CLASSIFYING BEHAVIOR RATHER THAN RELYING ON JUST ONE. MANY FINDINGS FROM THIS STUDY CAN BE INTERPRETED AS LENDING SUPPORT TO THE CONTINUED USE OF THE STRUCTURE OF INTELLECT IN THE PROFESSIONAL EDUCATION OF TEACHERS BOTH AS A DESCRIPTION OF INTELLECT AND AS A TAXONOMY OF EDUCATIONAL OBJECTIVES, AT LEAST FOR THE FACETS OF THE MODEL INVESTIGATED IN THIS STUDY. (IM)

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CG 001 259

September 30, 1967

CLASSIFICATION ABILITIES AS RELATED TO INSTRUCTION AND ACHIEVEMENT IN EARLY ADOLESCENCE

A pilot investigation designed (1) to study the ability of children in regular classroom settings to organize information they possess in ways suggested by two dimensions of the Guilford Structure of Intellect Model, and (2) to evaluate the feasibility and desirability of making participation in the study--in data collection and analysis--an integral part of the professional education of potential teachers.

The final technical report--Contract Number OE-6-10-305

Submitted to the Small Contract Program, Cooperative Research Branch, Office of Education, U.S. Department of Health, Education and Welfare.

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September 30, 1967

ACKNOWLEDGMENTS

This study could not have been undertaken without the active participation of two groups of students--college students enrolled in the teacher education program at California State College, Fullerton, California, in the spring of 1966, who designed the items for the instruments and acted as interviewers in data collection, and junior high school students at Nicholas Junior High School, who served as subjects during five hours of testing. The investigator is deeply indebted to both groups of students for their contributions of time, effort, and interest.

The participation of the subjects was made possible through the cooperation of the Fullerton School District. The Superintendent, Dr. D. Russell Parks, read the research proposal and was kind enough to give his permission for the participation of pupils in the district. Mr. Owen H. Richelieu, then Principal of Nicholas Junior High School, secured the cooperation of his teachers and extended every courtesy to the project staff. Mrs. Bette McCoy, always a stimulating teacher, encouraged her pupils to enter into the research tasks with enthusiasm and determination. Their cooperation was based on the conviction that sound teacher-education rests with the practicing administrator and teacher as well as with the collegiate institutions. This cooperation and support is gratefully acknowledged.

Dr. J. P. Guilford's brilliant contribution to psychology, The Structure of Intellect, must also be acknowledged in any study which is based on ideas it contains. However, since Dr. Guilford has had no direct involvement in the study reported here, he cannot be held responsible for any of its shortcomings.

INTRODUCTION

Problem

To be involved in the professional preparation of teachers is to be haunted by the question--does the instruction that the potential teacher receives in my class influence significantly the kind of teacher he will eventually become? One finding about learning that is supported by research, regardless of the problem investigated or the theoretical stance of the investigator, is that--if something which has been learned is to transfer, is to be resistant to forgetting and extinction, is to generalize, it must be thoroughly learned, its applicability to a wide range of problems must be demonstrated and its generalizability stressed. In view of these realities, the teacher of teachers must select with great care the content to be emphasized in his instruction. Having done so, he must plan experiences for his students which are most apt to result in such thorough learning.

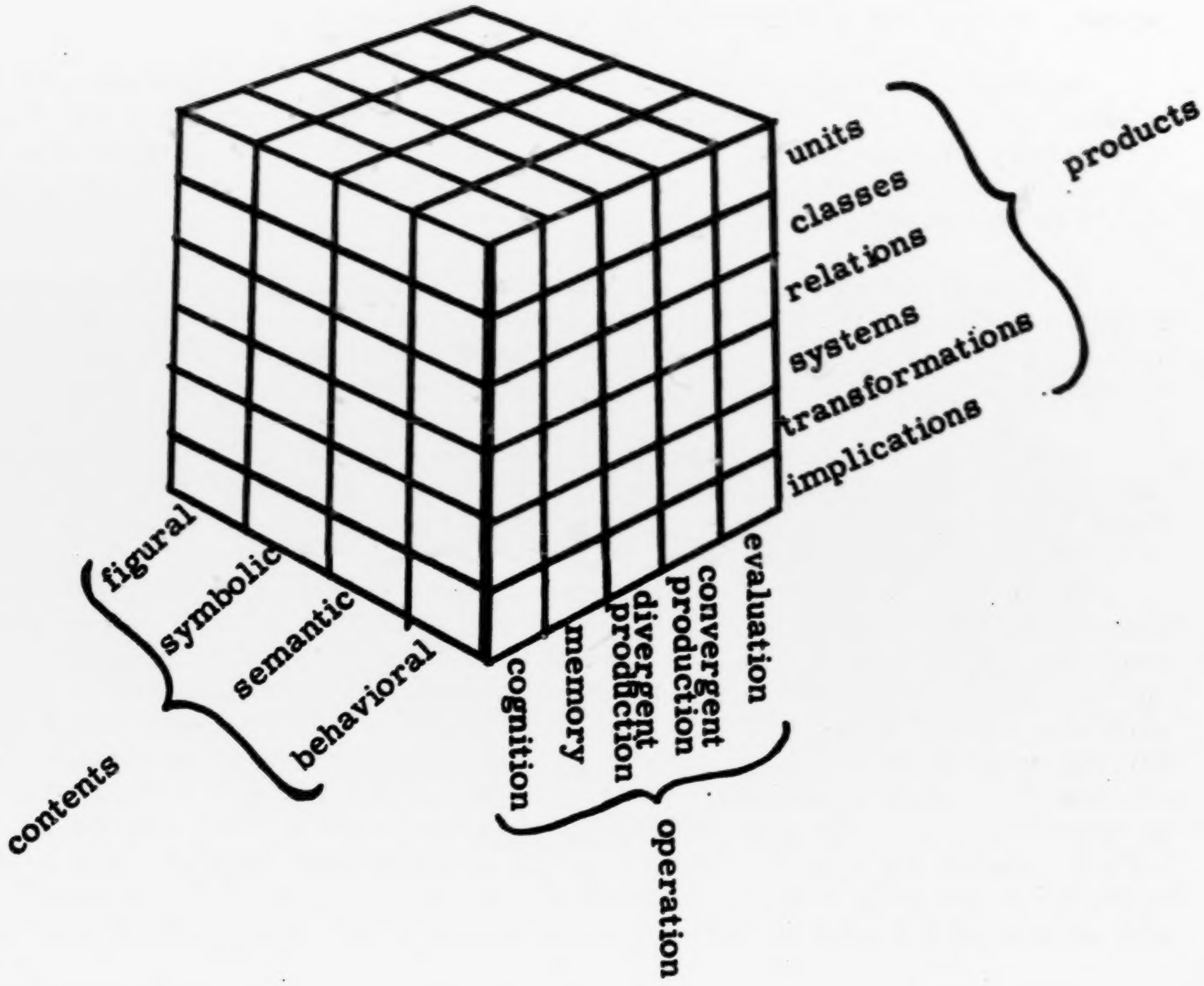
At California State College at Fullerton, the responsibility for teaching the potential teacher about cognition and intelligence has been assigned to a course entitled, Psychological Foundations of Education. Each instructor of this class must select or devise a theory that seems to him to be potentially of most value to teachers--a theory regarding cognition and intelligence which, if thoroughly understood by the potential teacher, is most apt to influence the way he will eventually teach. Before considering the question of which theory is the most promising, a prior question is in order--of what use to teachers is knowledge about intelligence? Our answer to the question is that the teacher should understand intelligence so that he will be able to help the children or youth he teaches to respect, value and take pride in enhancing their own intelligence. If teachers lack the understanding and skill necessary to help children demonstrate their intelligence, the tragic result may be distrust and rejection by some children both of the schools and of their own intellect.

Typical classroom instruction relies heavily on memory of factual verbal material--on the ability of the pupil to remember information that has been presented in much the same form and in connection with the same contextual cues with which it was learned. The teacher knows very well how to elicit, recognize and reinforce evidence of intelligence when it is thus defined. Classroom instruction relies heavily, also, on the ability to follow prescribed procedures and to come up with correct answers. Children who possess the kinds of intelligence and the motivation which permits them to go through these procedures and produce these correct answers will have many success experiences in school. Many children and youth, however, are unable or unwilling to demonstrate intelligent behavior when intelligence is thus narrowly defined. All teachers know about individual differences in intelligence, but few know what to do about it. More devastating is the fact that the teachers of teachers seem to be able to help them very little. We have suggested that the teacher should understand intelligence so that he will be able to cultivate it. According to reinforcement theory, he can foster it best by eliciting intelligent behavior or by recognizing emitted intelligent behavior and by reinforcing it. The emphasis on intelligence in our instruction of potential teachers is aimed at helping them discover ways to elicit intelligent behavior from all of their students and to recognize intelligent behavior when they see it. With this as our goal, the definition of intelligence we use must be inclusive, detailed and specific.

It is, of course, true that there exists no established definition or description of intelligence upon which all authorities can agree. The teacher cannot wait for the scientific establishment of "the whole truth" concerning the structure and function of the human nervous system. Rather, he must use the most promising theory he can find or devise and exploit it to the fullest, while realizing that it is tentative and imperfect. The test of a theory rests with the extent to which it is compatible with accumulated knowledge and the extent to which it stimulates further research and exploration. J. P. Guilford's Structure of Intellect model meets both of these tests and, in addition, meets a third which is indispensable if a theory is to be useful to teachers--parsimony. An understanding of the Structure of Intellect tests on the grasp of only fifteen terms. True, these fifteen concepts become useful as operational definitions only after considerable analysis and application, but the typical teacher-education student in his junior or senior year of college can acquire a working knowledge of the model within the span of a single semester.

J. P. Guilford's model which he calls Structure of Intellect and which was described in relatively non-technical terms in an article published in the American Psychologist, 1959, 14, 469-479 under the title "Three Faces of Intellect," is the theoretical basis for the study. The model of intellect hypothesized describes all intellectual acts as representing one of four kinds of content--figural, symbolic, semantic or behavioral; one of the five operations--cognition, memory, divergent production, convergent production, and evaluation; and one of six products--units, classes, relations, systems, transformations, and implications. According to the theory, any intellectual task a person performs can be seen as representing one of the four kinds of content, one of the five operations, and one of the six products. Guilford and his associates are attempting to test the hypothesis through the use of factor analysis that intelligence is made up of 120 distinct abilities, each represented by the point in the model where the three faces intersect. Their work, then consists of trying to discover ways of isolating and measuring these 120 kinds of mental ability. Figure 1, on page 3, gives a graphic representation of the model.

FIGURE I


units
classes
relations
systems
transformations
implications
products
figural
symbolic
semantic
behavioral
contents
evaluation
convergent production
divergent production
memory
cognition
operation

Psychologists have not given the model their unqualified endorsement. It is much too soon to say whether future work by Guilford and his associates will be able to satisfactorily answer the criticisms now directed toward the model. Even though its validity as a model of intelligence has not been and may never be established, its usefulness to the teacher and to the teacher of teachers is substantial. The prospective teacher in his training is introduced to subject matter intended to help him understand the nature of intelligence and its measurement. He is also introduced to teaching methodology, but rarely is he helped to see the relationship among the nature of intellect, the nature of academic subject matter and the nature of teaching methodology. This state of affairs exists, we suspect, because definitions of intelligence heretofore have not lent themselves readily to the demonstration of such relationships. The Structure of Intellect presents intelligence as a number of discrete abilities which, when combined in various ways, are readily translatable into subject matter as it is taught in the public schools. In short, the Structure of Intellect seems to have great promise as a tool for helping teachers: (1) to be able to describe the intellectual capacities a learner must utilize in order to "learn" various subject matters; (2) to set goals and objectives which give students experiences in utilizing appropriately as much of their intellectual potential as possible in dealing with each phase of the curriculum; and (3) to design classroom activities and teaching aids appropriate to intellectual development as broadly conceived, as well as the mastery of subject matter.

Generally speaking, college students who study the Structure of Intellect find it stimulating. They share their instructor's enthusiasm for it as a sort of taxonomy of educational objectives. They participate extensively in designing instructional materials and exercises purporting to elicit the kinds of thinking the model incorporates.

It is fairly safe to assume that many students who are introduced to the Structure of Intellect in this way intend--sometime in the future when they become teachers--to try to teach in a manner that will stimulate their pupils to use all of the facets of intelligence hypothesized by the model.

Strangely, confidence that one has accomplished this much through instruction rather than allaying the anxieties of the teacher of teachers, multiplies these anxieties.

Now a host of potential problems become very real. The nature of the questions change from "Can the student who teaches history, for example, re-cast the subject matter of his discipline which is usually presented in a narrative fashion in books and films, into classroom exercises which call for classifying, seeing relationships, systemetizing, etc.?" to "When the teacher devises exercises calling upon his pupils to classify, see relationships and to systemetize, will his history pupils or his third graders be able to perform as predicted? And, if the teacher does re-cast his subject matter in these ways, will he really be stimulating a kind of intellectual behavior which is of more value to the pupils than the relatively straight-forward traditional question and answer techniques with which the teacher's own intelligence was nourished?"

These are the kinds of concerns that led up to the study described in this report--a study to determine whether college students in a teacher-education program can devise techniques and exercises which will stimulate eighth grade subjects to classify information utilizing the five operations hypothesized by the Structure of Intellect model.

The Structure of Intellect postulates six products--units, classes, relations, systems, transformations, and implications--any of which could have been selected as a starting point for a series of studies purporting to test the practicality of using the Structure of Intellect as a taxonomy of education objectives.

The product classes (the ability to classify) was selected for this initial study, in part at least, because exercises calling upon learners to classify information in the classroom, using any but the operation of memory, are apparently rare.

To summarize, the problem for this study is to gather data with which to test some of the assumptions on which our use of the Structure of Intellect in the professional education of teachers is based.

Objectives

The objectives of this study are to gather data with which to assess the soundness of the practice of using the Structure of Intellect as a taxonomy of educational objectives in the professional preparation of teachers. Data will be gathered which are seen as relevant to the following premises:

1. That eighth grade subjects have many concepts learned through out-of-school experiences which could be used to make classroom instruction more meaningful and personal, and that an inventory of such words and concepts may be obtained quickly by a teacher using Divergent Production of Units techniques.

2. That, using words and concepts suggested by the subjects themselves, college students (and therefore, practicing teachers) can devise exercises which are consistent with the intellectual abilities hypothesized by the Structure of Intellect and which are within the capabilities of the pupils.

3. That a systematic examination of the manner in which eighth graders respond to such teacher-made exercises will contribute in meaningful ways toward an understanding of the hypothesized intellectual ability, of the pupils as individuals, and of *the technique designed to elicit* the behavior.

4. That the abilities tapped through the use of teacher-made instruments designed to tap intellectual abilities will be found to be related to school achievement in ways which are interpretable.

5. That, abilities described by the Structure of Intellect as relatively independent will be found to be relatively independent even when the method of eliciting the behavior is modified as it may become in the hands of a teacher using the exercises to promote rather than measure intelligence.

Procedure

Data for the study were gathered from the pupils in two sections of eighth grade English meeting in their regular classrooms and during regular class time on five successive Thursday mornings in the late spring of 1966. During the first of these sessions, answer sheets were distributed, and the subjects were requested to write all of the words which were suggested to them by the topic word LAW. They were discouraged from stream-of-consciousness association by instructions to "write only those words that the word LAW makes you think of." At the end of the first data gathering session, the answer sheets were collected from all subjects. An alphabetized list of all the different words produced by the members of both English classes was prepared by the project staff. This master list of over 400 words was duplicated and distributed to college students in their college class, Psychological Foundations of Education, on the following day.

Using these basic lists of words, and formats suggested by the investigator as being consistent with the Structure of Intellect definition, the college students designed the classification items which were then administered to the eighth grade subjects in four additional data gathering sessions. By way of illustration, in the week between the first data gathering session and the second, the college students designed items purporting to elicit Convergent Production of Classes and Memory of Classes responses. Then, in the week between the second and the third data gathering sessions the college students designed additional items for Convergent Production of Classes and so forth. From among the large quantity of items prepared by the college students, the project staff selected items and prepared the instruments. Insofar as the time available permitted, the items were edited and refined. An attempt was made to select items for inclusion in the instruments which utilized a wide variety of concepts and would be challenging to the subjects.

Following is a time-table which describes the sequences in which the classification tasks were administered to the subjects.

First Data Gathering Session - DIVERGENT PRODUCTION OF UNITS: Writing words associated to the stimulus word LAW.

DIVERGENT PRODUCTION OF CLASSES: Subjects classified words in any way they saw fit, using words from their own lists, any of the 100 words written on the chalk board, and any other words they could think of that could be used to produce three-word classes.

Second Data Gathering Session -CONVERGENT PRODUCTION OF CLASSES INSTRUMENT PART I.
Instruction for the Memory of Classes task.

Third Data Gathering Session - MEMORY OF CLASSES INSTRUMENT.
CONVERGENT PRODUCTION OF CLASSES INSTRUMENT PART II.

Fourth Data Gathering Session -COGNITION OF CLASSES INSTRUMENT.

Fifth Data Gathering Session - EVALUATION OF CLASSES INSTRUMENT AND INTERVIEWS.

Fifty-four eighth grade subjects completed all phases of data gathering. A cumulative record sheet was prepared for each of the fifty-four subjects. Information including teachers grades for seventh and eighth grades in all subjects, scores on the California Test of Mental Maturity and the California Achievement Tests administered to all subjects in the eighth grade, chronological age, and sex was entered on a cumulative record sheet for each subject.

General Design

The general design for the study consisted of administering the classification tasks described above, scoring these instruments for quantity where appropriate, for accuracy where appropriate, and for quality where appropriate. In addition to these scores, scores obtained by the subjects on the CTMM and CAT, and teachers grades were entered on data cards for IBM processing.

Means and standard deviations were computed for all variables, and all variables were intercorrelated using Pearson Product Moment Correlation.

In addition to this statistical treatment, scores for the fifty-four subjects were distributed by stanines on several variables. This procedure allowed the performance of individual subjects on any classification task to be compared with his performance on the remaining classification tasks and his standing on CTMM IQ and Grade Point Average. Profiles were prepared for all subjects.

Description of Sample

Subjects for this investigation were pupils enrolled in two sections of eighth grade English in the Nicholas Junior High School, Fullerton School District, Fullerton, California. Data were gathered in the classroom during regular class periods on five successive Thursdays in April of 1966. Fifty-four pupils completed all research tasks. Cumulative data sheets were prepared for the subjects. Data from these cumulative record sheets are summarized on Table I.

TABLE I

SUMMARY OF DATA FROM CUMULATIVE RECORDS

Variable	Mean	SD
Grade Point Average[a]		
Math	1.8	.63
Reading	2.0	.66
English	2.0	.65
Spelling	2.6	.84
History	1.9	.66
Total	2.1	.58
California Test of Mental Maturity		
Language IQ	101.9	11.1
Non-language IQ	101.1	14.9
Total IQ	101.7	10.5
California Achievement Test		
Reading Vocabulary Percentile	65.1	17.7
Reading Comprehension Percentile	53.9	23.2
Arithmetic Reasoning Percentile	39.7	21.9
Arithmetic Fundamentals Percentile	33.6	21.4
English Mechanics Percentile	64.1	18.5
Spelling Percentile	63.6	26.7
Chronological Age	13.3	.943

[a] A=4; B=3; C=2; D=1; F=0

The means and standard deviations reported in Table I demonstrate that the two classes studied were if anything slightly below average groups, both in terms of measured IQ and grade point average. In terms of achievement as measured by standardized tests the sample is below the norms for both arithmetic reasoning and arithmetic fundamentals. Otherwise, all are above the median. It was our intent to study typical junior high school students--to avoid classes homogeneously grouped as either gifted or slow learners. The mean IQ of 101.7 indicates that our sample is average, a standard deviation of 10.5 indicates that the sample contains few extremes. The highest IQ reported was 136, and the lowest was 72. The findings of the study therefore may be said to be applicable to typical eighth grade students.

Data and Instrumentation

The unique feature of this project is that the items to be used in the instrument were designed by college students using words produced by the subjects themselves. One of the primary goals of the study was to discover whether items designed by college students in accordance with the definitions used by Guilford in his descriptions of the Structure of Intellect would allow the subjects to demonstrate the kinds of differences hypothesized by the model.

Since an analysis and evaluation of the classification instruments is an integral part of the study, descriptions of them and the kinds of data they produce are discussed in Part II of this report.

Limitations of the Study and the Report

1. Statistical treatment: It has been the intent of this study to try to elicit the intellectual abilities described by the Structure of Intellect as they may be elicited in a regular classroom setting with instruments and techniques such as a teacher realistically might be expected to devise and utilize, and to score and treat the data in much the same fashion as a teacher might tally and score his own tests and teaching exercises. Data gathered and scored in this way, and with untested instruments, are not precise enough to lend themselves to sophisticated statistical analysis. For these reasons many statistical procedures that might have been appropriate to a more carefully controlled study have not been employed. The correlation coefficients reported throughout the study should be interpreted as merely suggestive.

2. Terminology: There has been no attempt in this report to differentiate among the terms, "classes," "categories," and "sets." The three terms are used interchangeably. The word "category" was used consistently when communicating with the subjects because a trial run had demonstrated that with eighth grade children the term "category" conveys essentially what Guilford means by his term, "classes."

3. Related research: The most obvious weakness of this report is its failure to relate the procedures, terminology and findings to the work of other investigators in the field. This deficiency will be rectified before the material in this preliminary report is submitted for publication.

4. Documentation: Until the very recent publication of Guilford's new work, The Nature of Human Intelligence,[1] it was impossible to know the current status of ideas which have appeared from time to time in progress reports from his laboratory. The publication of this definitive work will permit much more coherent documentation. Therefore, a minimum of documentation appears in this preliminary report.

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[1] Guilford, J. P., The Nature of Human Intelligence, New York: McGraw-Hill, Inc., 1967

5. **Interpretations of the Findings:** This study was initiated by a teacher of teachers with the purpose of evaluating a practice designed to improve the quality of preparation of the prospective teacher. During the analysis of the data, certain ideas which seem relevant to the teacher-education program have occurred to the investigator. Some of these ideas which may not seem to be entirely warranted by the data may have found their way into this report.

DIVERGENT PRODUCTION OF CLASSES

Definitions

Divergent Production: "Generation of information where the emphasis is upon variety and quantity of output from the same source.

Classes: "Conceptions underlying sets of items of information grouped by virtue of their common properties."[1]

Operational Definition-Divergent Production of Classes: To generate or produce, from the same source, a variety and or quantity of classes, sets, or categories in which items are grouped by virtue of their common properties.

Data Collection

Data relevant to Divergent Production of Classes were gathered during the first data gathering session as a two-step process. The first step is referred to throughout this report as Divergent Production of Units, and consisted of an exercise in which the subjects wrote all of the words and ideas suggested by the stimulus word LAW.[2] At the end of ten minutes, the subjects were instructed to write the word "time" on their answer sheets in the space after their last word. Subjects kept these answer sheets in their possession during the remainder of the session, and were instructed to add to their lists if they felt like doing so during the discussion which intervened between the Divergent Production of Units task described above and the Divergent Production of Classes task which is to be described shortly.

While their answer sheets were still in the possession of the subjects, by way of illustrating the great variety of words suggested by the subjects, the investigator made a list of words on the chalk board. This was accomplished by having each subject, in turn, call out a word from his list until some 100 different words had been mentioned. This list of words remained on the chalk board during the remainder of the session. Now, each subject had access to his own list of words, and to the list on the chalk board contributed by him and his classmates.

At this point in time, the Divergent Production of Classes answer sheet was distributed to the subjects. This sheet was subdivided into a number of boxes, and was otherwise blank except for instructions at the top of the page.[3]

The investigator read the instructions aloud as the subjects read them from the answer sheets. A short discussion was conducted in an effort to clarify the nature of the task. The following example was used as illustration: "(TEACHER, PREACHER, NEWSCASTER). You might put these together into a category because they are all people who talk a lot. (TEACHER, DOCTOR, LAWYER) These are all professions. (TEACHER, BOOK, DESK) These are all objects found in the classroom. (TEACHER, PROFESSOR, INSTRUCTOR) These go together because they describe people who perform the same function--synonyms."

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[1] Guilford, J. P. & Hoepfner, R., "Structure of Intellect Factors and their Tests, 1966." Aptitudes Research Project Publications, No. 37, University of Southern California, Department of Psychology.

[2] See Appendix Page 58, for copy of answer sheet.

[3] See Appendix Page 59, for copy of answer sheet.

The instructions directed the subject to think of as many three-word categories as he could and to write each category in one of the boxes on the answer sheet.

In short, (1) the subjects were asked to write all the words suggested to them by the stimulus topic LAW. Many of these words were written on the chalk board. (2) Then, subjects were asked to make as many three-word classes or categories as they could in thirty minutes using these words or any others they needed.

Treatment of the Data-Divergent Production of Classes-Quantity/Variety

Three Divergent Production of Classes scores for each subject were obtained--two by special treatment of the words (units) written in response to the stimulus topic LAW, and the third by a simple count of the three-word categories produced in response to the Divergent Production of Classes task. The first two scores (these obtained from a special treatment of the words produced to the stimulus, LAW) are considered evidences of "variety"--the third a measure of "quantity." The definition of Divergent Production, it will be remembered, stresses variety and quantity of output. The method of arriving at variety scores is discussed first.

Variety of Classes

Each subject wrote as many words as he could think of in response to the topic in a ten-minute period. A master list of most of the words mentioned by all of the subjects was assembled. The words were arranged by the project staff into nine major divisions and thirty-one subdivisions as follows:[1]

	Major Divisions	Number of Subdivisions
I.	High level abstractions	1
II.	Forms, Definitions, Purposes	3
III.	Enumeration of legal documents or Specific Laws	5
IV.	Pertaining to Legislation	1
V.	Pertaining to Govt.--Miscellaneous	6
VI.	Pertaining to Enforcement	6
VII.	Pertaining to Judicial System	5
VIII.	Pertaining to Law as a Profession	3
IX.	Other	1

Total number of major divisions--9 Total number of subdivisions--31

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[1] See Appendix Page 73, for a copy of this scoring key.

The words, arranged in this manner and under these headings, were reproduced as scoring keys. The responses of each subject were transferred to a scoring key bearing his code number by circling the words on the scoring key that appeared on the list he had written during data gathering. Thus, it became a simple procedure to count the number of major divisions and subdivisions under which his words had been tallied.

For example, one subjects may have written thirty words all of which were tallied under the Major Division VI, "Pertaining to Enforcement." In such a case the subject's Major Division score would be "1." If this hypothetical subject's words were tallied within all six subdivisions under Major Division VI, his subdivision score would be "6."

The number of Major Divisions a subject's words were tallied under constituted one measure of variety and the number of Subdivisions constituted a second measure of variety.

Quantity

The second type of data relevant to Divergent Production of Classes comes from the task requiring subjects to write as many three-word categories as they could in thirty minutes. Scoring amounted to a simple count of the number of three-word combinations written. There was no upper limit specified for this task. Time constituted the only limitation. In the thirty minutes allowed for the task, the most prolific subject wrote fifty-six sets of three words and the least prolific wrote as few as nine such sets.

Findings

For each subject, three scores are available as relevant tp Divergent Production of Classes. The scores are (1) Number of Major Divisions under which words on the Divergent Production of Units task were tallied (DPU-Major Division), (2) The number of subdivisions under which words on the Divergent Production of Units task were tallied (DPU-Subdivision), and (3) The total number of three-word sets written in the Divergent Production of Classes task (DPC-Quan).

These three variables were intercorrelated. The data are summarized on Table 2-1, below:

TABLE 2-1
SUMMARY OF INFORMATION OF THREE VARIABLES
RELEVANT TO DIVERGENT PRODUCTION OF CLASSES

Variables		Extremes				Intercorrelations		
	Possible	Low	High	Mean	SD	(1)	(2)	(3)
1. DPU-Major Divisions	9	3	8	5.9	1.3	---	.699	.323
2. DPU-Subdivisions	31	5	18	12.4	2.7	.699	---	.306
3. DPC-Quan	No Limit	9	56	25.6	8.7	.323	.306	---

Significance Levels: .269 at .05; .348 at .01; .453 at .01.

We see from row 1, in Table 2-1, that DPU-Major Division correlates to a considerable extent with DPU-Subdivision (.699). This high correlation is predetermined to a certain extent by the manner in which the scoring manual was arranged. A low correlation could have occurred only if a pattern like the following had been typical of the sample: Six or seven words tallied one each in several major divisions together with a piling up of the remaining words in one or two subdivisions. The high correlation obtained confirms what one might expect--that if the words a person thinks of fit into a variety of major divisions, they will also be distributed into a variety of subdivisions. This suggests that the subdivisions breakdown on the scoring manual added little to our analysis and is dropped from further consideration in this report.

Line 1, of Table 2-1, reports a correlation between DPU-Major Division and DPC-Quan. of .323. Although a positive correlation of this magnitude would not lead us to conclude that a measure of quantity is also apt to be a measure of variety, it does allow us to reject the opposite--that the production of quantity reflects a tendency to confine oneself to a narrow range of ideas.

The data summarized on Table 2-1 shows that there are very great differences among eighth graders, especially in the DPC-Quan. measure. In an attempt to learn whether these differences relate in any way to school achievement or aptitude, the DPU-Major Division and DPC-Quan. scores were correlated against 15 scores from the cumulative records. These correlations are reported in Table 2-2.

TABLE 2-2
CORRELATIONS BETWEEN CUMULATIVE RECORD VARIABLES
AND VARIETY OF CLASSES AND QUANTITY OF CLASSES[a]

		DPU # of Major Divisions	DPC Quan
(1)	Math GPA	125	136
(2)	Reading GPA	280	195
(3)	English GPA	191	205
(4)	Spelling GPA	239	209
(5)	History GPA	214	142
(6)	Total GPA	254	202
(7)	CTMM Language IQ	251	049
(8)	CTMM Non-language IQ	-119	007
(9)	Total IQ	048	071
(10)	CAT Reading Vocabulary	278	083
(11)	CAT Reading Comprehension	254	023
(12)	CAT Arithmetic Reasoning	-011	001
(13)	CAT Arithmetic Fundamentals	124	007
(14)	CAT English Mechanics	041	186
(15)	CAT Spelling	228	301

[a]Decimal points omitted.
Significance levels: .269 at .05; .348 at .01.

The most impressive thing about Table 2-2, is the paucity of correlations that approach significance. Of the 30 correlations reported, only three are significant beyond the .05 level. Row 2, shows a correlation of .280 between DPU-Major Divisions and teachers' grades in reading. Row 10, reports a correlation of about the same magnitude between this variable and CAT Reading Vocabulary. Despite these correlations and a correlation of .301 between CAT Spelling and DPU-Quan. on Row 15, it is safe to generalize from Table 2-2 that the Divergent Production of Classes ability as it was tapped in this research is essentially unrelated to academic aptitude or achievement.

Having demonstrated that the DPC-Quan score is positively and significantly related to Variety of Classes as tapped on a quite different kind of task and type of analysis (DPU-Major Divisions), DPC-Quan is retained as the single measure of Divergent Production of Classes throughout the remainder of this report.

Treatment of Data-Divergent Production of Classes-Quality

The preceding section of this paper has described methods of scoring for Divergent Production of Classes when the ability is confined to variety and quantity. A cursory examination of the three-word combinations written by the subjects in response to a request to write three-word categories, revealed substantial differences in quality of output. How to resolve the dilemma of whether to score or not to score for quality? In one respect, the practice of evaluating quality in an ability (divergent production) defined as emphasizing "quantity and variety of output" appears to be a contradiction in terms. While in another respect, assuming that any three-word combination should be called a class does violence to the part of the definition which specifies classes as items of information "grouped by virtue of a common property."

This issue was handled by a decision to score the protocols for quality and to postpone until later the decision as to whether to call the resulting scores measures of Divergent Production or to assign them to one of the other operations. For reasons of clarity, however, the procedure to be described is referred to throughout the report as Divergent Production of Classes--Quality (DPC-Qual).

Scoring Procedures and Comments on Scoring

A five-point rating scale was devised and criteria were developed for each rating. A rating of 5 represented the highest score any class could be given. In an effort to achieve consistency in scoring, two judges rated each protocol. Where there were disagreements between the judges on an item, the differences were resolved through discussion.

Before beginning this description, it may be well to repeat that the classes being evaluated here, were written by the subjects in thirty minutes, in response to a request that they write as many three-word categories as they could using words they had just produced in association to the word LAW. The fifty-four subjects wrote a total of 1381 three-word classes. Each subject's handwritten protocol was typewritten and spelling errors were corrected before the ratings were done.

Quality Ratings of 5

Criteria 1-All three words must be the same part of speech so that the rater can say "These go together because they are all ... people, places, objects, institutions, functions, processes, qualities, documents, adjectives, etc., and
2-have the same relationships to a superordinate heading, or
3-are on the same level of abstraction, or
4-are on the same level of generality, or
5-are synonyms

Certain concepts which meet our criteria are learned in sets of three. The following examples appear frequently: (LEGISLATIVE, EXECUTIVE, JUDICIAL), (DEMOCRACY, COMMUNISM, SOCIALISM),(JUSTICE, FREEDOM, LIBERTY).

Following are other examples: (FBI, CIA, SAC), (AGENTS, G-MEN, DETECTIVES), (BAD, MEAN, TERRIBLE), (AMENDMENT, CHANGE, ADDITION), (FATHER, MOTHER, BROTHER), (FATHER, JUDGE, PRESIDENT), (JUVENILE, MINOR, CHILD), (PROSECUTOR, DEFENDANT, VICTIM), (MURDERER, KIDNAPPER, SMUGGLER), (PRISON, JAIL, DUNGEON), (ELECTRIC CHAIR, GAS CHAMBER, FIRING SQUAD), (SUMMONS, CALL, DRAFT), (BAD, ILLEGAL, WRONG), (SUBPOENA, TICKET, CITATION), (ORDER, ASK, REQUIRE), (STATE LAW, COUNTY LAW, CITY LAW).

Ratings of five points were also assigned to classes in which raters could discern an effort by the subject to capture an illusive concept, which had fallen short only because of inability properly to convert nouns into verbs or verbs into adjectives, etc.

(FUGITIVE, ESCAPE, RUN-AWAY), (RESTRICTION, PROHIBITED, ORDER), (INCOGNITO, FALSE, DISGUISE), (TRESPASSING, OFF LIMITS, PROHIBITED), (BILL, FINE, TICKET).

We cannot leave these examples without commenting on the truly remarkable potential we see in this exercise for stimulating an interest both in ideas and in precise ways of communicating them. In these exercises the youngsters are working with ideas and concepts they already have. By placing three words together into a class they are demonstrating that they have a concept. What a superb opportunity for a teacher to use the excellence a pupil has demonstrated to encourage him to take the next step--that of finding the most precise way of labelling or communicating his concept.

Frequency of Response

Our findings indicate that a very small percent of the total 1381 classes produced meet the criteria for the highest rating (11%). All but six subjects had at least one of their classes scored five points. The subjects differed both in the absolute number of classes receiving a rating of five and in the proportion of their total classes being so rated. The highest absolute number of classes scored five for any one subject was nine. The highest proportion of total classes scored five for any one subject was 39%. The mean number of five point classes per subject was 2.5.

Comments

It is difficult succinctly to describe the process followed by the individual in performing the task. He did not have unlimited freedom since he was instructed to begin his class with a word that had been associated to the word LAW and was either on his own list or written on the chalk board. Beyond this, he was free to search among all the words he knew to find two others to go with his first. Some of the words associated to the word LAW represented concrete objects--GUN, BADGE, AMBULANCE--but many of the words written on the chalk board were abstract--GOVERNMENT, ILLEGAL, VERDICT, etc. The eighth graders could have selected a word that stood for a concrete object making the task considerably easier, but generally speaking, they did not.

We might typify the process, then, as one in which the subject began a class with a fairly abstract concept from those given and then searched among all the words he knew to find two more words to go with it. Our findings suggest that eighth graders, as far as our sample is typical, far more often than not, are unable to find three words that share both intrinsic commonalities (same part of speech) and common levels of abstraction. In the discussion of four-point classes which follows, one kind of difficulty they experienced is illustrated.

Quality ratings of 4

Criteria 1-All three words in the class must be the same part of speech so that the rater can say "These go together because they all... are people, places, objects, events, documents, processes, etc."
2-They fall short of earing a 5 rating because of mixed levels of abstraction or generality, or
3-Because they lack a common orientation in relation to a superordinate heading.

Examples: (POLICE, COP, BATMAN) These go together because they are all people, but the first two are general and the third, BATMAN, is specific. (DEATH, MURDER, SUICIDE) These three go together because they are all processes, but the second two are instances of the heading DEATH. (LEADER, DICTATOR, KING) Dictators and kings are both leaders; (BYSTANDER, PEOPLE, FATHER) Father and bystander are both people; (PUNISHMENT, FINE, ELECTRIC CHAIR) all consequences of being found guilty, but fine and electric chair are forms of punishment; (DOCUMENTS, CONSTITUTION, MAYFLOWER COMPACT) Constitution and Mayflower Compact are specific documents; (RELIGION, CATHOLIC, MORMON) Catholic and Mormon are types of religion.

In these examples, we can glimpse the effort of the subjects to group together only words of the same part of speech. It looks very much, however, as though the subject used his first word as a heading and then found two others which were examples of the first.

Frequency of Response

Nineteen percent of all classes produced were assigned ratings of "4". All subjects had at least one of their classes so rated. The highest number of "4" ratings achieved by any subject was 12, while the highest proportion of total classes rated "4" for any subject was 65%. The mean per individual for the sample was 4.9 four-point classes.

Comments

In the above examples, we are struck by the classic examples of mixed levels of abstraction produced by these youngsters. It is doubtful whether any teacher or author could create workbook exercises which are any more graphic.

Quality Ratings of 3

Criteria 1-Two words that are the same part of speech so that the rater can say, "These two are ...people, places, processes, events, etc."
2-A third word of different part of speech which relates to both of the other two in an asymmetrical way.

Examples: (JUDGE, JURY, TRIAL), (GUILTY, INNOCENT, VERDICT), (OBEY, DISOBEY, RULES), (PRESIDENT, LEADER, IMPORTANT), (LESSONS, HOMEWORK, TEACHER), (LOOK INTO, INVESTIGATE, FBI), (DIVORCE, BREAK-UP, ARGUMENT).

In several of these items the subject began with a set of opposites, for example (GUILTY and INNOCENT). In this particular item there is no way for the subject to complete a three-word class that would meet criteria for 5 points unless he were able to come up with something as sophisticated as HUNG JURY or MISTRIAL for his third word. So, in a sense, starting off with a pair of opposites poses nearly unsolvable problems for the subject. Beginning with a pair of synonyms, also poses considerable difficulty. In the example, (OFFENSE and CRIME), the subject could have completed a 4-point class by adding a word like ROBBERY or FELONY but to achieve a five-point class he would have had to come up with a word like ILLEGALITY.

Frequency of Response

Twenty-six percent of all classes produced were rated "3". The greatest number of such classes written by a subject was 14. The highest proportion of total classes scored "3" for any individual was 66%. Mean for the sample was 6.7 per subject.

Comment

One can only speculate, of course, but perhaps the problem leading to this kind of response is lack of foresight--the tendency to write a pair of words which frequently occur together in common usage before one has tested to see whether he can find a third.

Quality Ratings of 2

Criteria 1-Three words are of different parts of speech--verbs, nouns, adjectives.
2-All seem to relate to each other as part of a sequence, event, or setting.

Examples: (VETO, BILLS, NO GOOD), (CURFEW, TIME, LIMIT), (TREATIES, COUNTRY, PEACE), (LIE DETECTOR, PRISONER, FALSIFY),(CITY HALL, LOCAL, ENFORCEMENT), (ARREST, INNOCENT, FREE), (TRAITOR, RAT, TREASON), (ARREST, CRIME, PUNISHMENT).

In these items there seems to be no discernable effort to create a class except perhaps in a temporal. spatial, or situational sense.

Frequency of Response

Thirty-nine percent of all items were of this type. All but one of the subjects had at least one such rating. Mean for the sample was 10 per individual. One subject produced thirty-one classes that received ratings of "2." The highest proportion of total classes scored "2" for any individual was 66%

Quality Ratings of 1

Criteria 1-Three word combinations that do not meet the criteria for receiving a higher rating.

Examples: (ORDERED, LINE, ACCUMULATED), (CONGRESS, JURY, TRIAL), (OBEY, LAWS, CRIME), (DRIVING LAW, TRAFFIC TICKET, RIOT), (WITNESS, DIVORCE, CRIMINAL).

These items appear to be more nearly a continuation of the DPU tasks than attempts to find words that fit into a category based on a common attribute.

Frequency of Response

Only five percent of the total classes produced were rated "1." Since twenty subjects had no such scores, these one-point classes are excluded from further analysis in this report.

Distribution of Quality Ratings

Table 2-3 summarizes the data on the distribution of quality ratings.

TABLE 2-3

SUMMARY OF QUALITY RATINGS FOR CLASSES PRODUCED IN RESPONSE
TO DIVERGENT PRODUCTION OF CLASSES INSTRUCTIONS

	Quality ratings					
	(a) One Point	(b) Two Points	(c) Three Points	(d) Four Points	(e) Five Points	(f) Total
(1) Number	73	541	345	265	148	1381
(2) Percent of total	5%	39%	26%	19%	11%	100%
(3) Mean per subject	1.4	10.0	6.7	4.9	2.5	25.6
(4) Standard deviation	*	5.5	3.4	2.6	2.1	8.7

*Not normally distributed.

In table 2-3, we see that the modal rating was "2." These ratings were given to mixtures of parts of speech in which it appeared to the rater that the subject was naming three words which frequently occur together in context--words that constitute the basis of a sentence. The subject seemed to be making no effort to apply the test that was suggested during the instructions--"these go together because they are all..." The next most frequently assigned rating was "3", given to classes in which the subject seemed to be trying to classify, but made his task difficult by starting with a pair of opposites or synonyms and so completed the three-word set with a word (usually of a different part of speech) which related to both of the other words. The third most frequent rating was to "4" point classes in which the three words were of the same part of speech so that the rater could say, "these are all people, places, institutions, levels of government, etc," but represented different levels of abstraction. It was as though the subject thought of one word which he used as a "heading" then searched to find two words which could be subsumed under it. Five-point ratings were assigned to classes in which the words were all of the same part of speech and could be seen as "all being processes, people, qualities, etc." and in addition, shared a common level of abstraction. These kinds of classes accounted for only 11% of the total.

We may summarize by saying that the ability to construct classes with three abstract words--symbols for such concepts as institutions, processes, functions, etc.--which share a common level of abstraction seems to be poorly developed in eighth graders. Nearly 40% of their items could be seen as classes only as they represent words which frequently occur together in context. Nevertheless, from the nature of the vocabulary selected for their efforts and from the effort to classify discernable in 56% of their items (quality rating for 3, 4, and 5) we sense a readiness in these subjects to gain control of abstractions.

Validity of the Quality Ratings

The paragraphs above have described five styles of response to the DPC task and have described the frequency with which each was found among the total number of classes produced. The assigning of quality ratings of "2" points to some kinds of items and "3" points to others and so forth implies not only differences in style, but also a graduated scale of quality. The differences in quality implied by such gradations can be validated by demonstrating that higher correlations obtain between each rating and some criterion measure than obtain between the next lower rating and the same criterion measure.

Table 2-4 on the next page presents an array of correlations that are instructive in relation to this question.

TABLE 2-4

COMPARISONS OF NUMBER OF CLASSES ASSIGNED QUALITY RATINGS OF 2, 3, 4, AND 5 WITH CUMULATIVE RECORD VARIABLES AND OF IQ WITH ACHIEVEMENT VARIABLES[a]

	Number of Classes				CTMM
	2 Points	3 Points	4 Points	5 Points	IQ
Math GPA	116	-054	093	306	425
Reading GPA	251	033	033	168	202
English GPA	246	004	012	176	342
Spelling GPA	236	020	003	245	253
History GPA	150	-068	-024	379	347
GPA-Total	222	-015	018	309	337
CTMM Language IQ	061	-064	082	451	---
CTMM Non-language IQ	004	013	079	229	---
CTMM Total IQ	047	-038	100	403	---
CAT Reading Vocabulary	-017	-158	164	461	150
CAT Reading Comprehension	-050	-083	-009	351	465
CAT Arithmetic Reasoning	-104	-174	206	407	402
CAT Arithmetic Fundamentals	023	-151	082	321	396
CAT English Mechanics	136	032	069	163	229
CAT Spelling	221	064	206	285	048

[a] Decimal Points omitted
Significance levels: .269 at .05; .348 at .01; .435 at .001.

Assuming that the quality ratings which correlate best with the cumulative record variables related to school performance are of highest quality, the first three columns of the table tell us that classes we have rated "4" are not of higher quality than classes we have rated "2". Moreover, the large number of slightly negative correlations in the column dealing with quality ratings of "3" suggest that these are of the poorest quality.

However, since none of these 45 correlations involving "2", "3", and "4" point classes is significant and since there are no absolutely consistent increases or decreases when moving from one rating to another, it is fairly safe to conclude that what we have described as quality differences in assigning point scores of 2, 3, or 4, are apparently nothing more than sylistic differences. The one possible exception to this generalization is that the tendency to produce three-word combinations which mix classes and relations in the same item (quality ratings of "3") may be indicative of an intellectual habit which is antithetical of learning.

When the column in the table which presents correlations involving quality ratings of "5" is examined, a different picture emerges. In all correlations except those with GPA in Reading and English, the correlations are higher than for "2", "3", or "4" point classes, and ten of the correlations now reach statistical significance. Using cumulative record variables as the criterion of quality, then, we may conclude that only those classes which are composed of words sharing both an intrinsic attribute and a common level of abstraction should be considered to be of good quality.

Using the number of "5" point classes produced as a measure of quality (DPC-Qual), positive and significant correlations were found with ten of the fifteen cumulative record variables. Examination of Table 2-4 permits a comparison between the magnitude of these correlations with GPA and Achievement Test Scores and the magnitude of the correlations of CTMM IQ with these same variables. It is interesting to note that for Reading GPA, Spelling GPA, and CAT English Mechanics, neither CTMM IQ nor DPC-Qual correlates significantly. For Math GPA, Total GPA, CAT Reading Comprehension and Arithmetic Fundamentals both measures correlate significantly although correlations of the variables with IQ are of higher magnitude. For History GPA and CAT Arithmetic Reasoning both measures correlate significantly, but DPC-Qual has a very slight edge in terms of magnitude. Only in the case of English GPA does IQ correlate significantly while DPC-Qual does not, while in two instances, CAT Reading Vocabulary and CAT Spelling, DPC-Qual, correlates significantly while IQ does not.

To summarize, using the DPC-Qual (the number of classes produced which received a rating of "5") as a measure of academic aptitude, we find that it correlates significantly with eight measures of academic achievement while IQ correlates significantly with 7. While the magnitude of the correlations of these measures with IQ is considerably higher with Math GPA and CAT Reading Comprehension, the others are remarkably close, and the DPC-Qual is considerably higher than IQ in its correlations with CAT Reading Vocabulary (.461 as compared to .150).

The DPC-Qual measure correlates positively and significantly with both CTMM Language IQ (.451) and with Total IQ (403).

Summary-Divergent Production of Classes

Responses of the eighth grade subjects on a task requiring them to write as many three-word categories as they could revealed great differences among them in both quantity of classes produced and quality of classes produced. When scored for quantity, the scores were essentially unrelated to measures of academic aptitude, teachers grades or achievement test scores. When scored for quality, the scores were positively and significantly related to teachers' grades, to IQ, and to four out of five achievement test variables.

CONVERGENT PRODUCTION OF CLASSES

Definitions

Convergent Production: "Generation of information from given information where the emphasis is upon achieving unique or conventionally accepted best outcomes. It is likely the given (cue) information wholly determines the response.

Classes: "Conceptions underlying sets of items of information grouped by virtue of their common property."[1]

Operational Definition-Convergent Production of Classes: Generation of classes, sets or categories by selecting from an array of items those that share an intrinsic commonality when the nature of the commonality is not specified and where there is a best or uniquely correct answer.

Preparation of the Instrument

The preceding section of this report described a Divergent Production of Units task in which eighth grade subjects wrote words in response to the stimulus topic LAW. An alphabetized master list of all of the words written by the subjects was distributed to two sections of a college class composed of prospective teachers. Together with the list of words, the college students were given skeleton items, the form of which is described subsequently. The skeleton items included only the instructions which would appear on the instrument when it was administered to the subjects. The task for the college students was, using the words on the master list or variations of them, to prepare completed items to fit the directions. The items prepared by the college students constituted a pool of items from which the project staff selected those which were included in the instrument.[2]

Rationale for the Format of the Convergent Production of Classes Items

The test used by Guilford in his original work on this factor was a simple list of words which the subject was required to divide into two lists. In order to accomplish this task, the subject must literally create or produce classes--must decide what classes are embedded in the array of words. It was the wish to build variety into the tasks for the eighth graders that led us to experiment with the several different types of items finally used. The question of whether we succeeded in retaining what is essentially Convergent Production of Classes despite the variety of formats used is discussed later in this section.

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[1] Guilford, J. P. and Hoepfner, R., "Structure of Intellect Factors and their Tests, 1966" Aptitudes Research Project Publications, No. 37, University of Southern California, Department of Psychology.

[2] See Appendix Pages 60-65, for a copy of this instrument.

The Instrument

The instrument was composed of four kinds or types of items--Matching, Same-word Matching, List Division, and Crossword. Each type of item is illustrated in the material which follows:

Matching: Each matching item was composed of several boxes in each of which a class was begun with two words or terms. Included also was an array of words from which the subjects must select one word to write in each of the boxes so that the three words constitute a class. Item 3, from the instrument is reproduced below.

ITEM 3.

BRASS KNUCKLES GUN	GLOVES SHOES	MAYOR PRINCIPAL
DISTRICT CITY	MURDER ROBBERY	JUVENILE HALL JUVENILE COURT

ARSON
DELINQUENT
PRECINCT

HELMET
FATHER
SWITCHBLADE

The illustrated items contains six boxes (classes to be completed) and six words to be classified. For each word written into the box which was considered correct, one point was assigned. The matching items included twenty-four words to be matched with twenty-four classes.

Same-word Matching Items: This kind of item is a variation of the matching item. The item used with the subjects as an example, together with the instructions, is reproduced on the following page.

Instructions: Most words can be put into several different categories when we think of different ways in which they are used or when we group them with other words which share a common attribute. In the items below, a word is used to begin each of several different categories. In the sample item, #8, two words have been added to the word POLICEMAN in each column to give us a clue as to the category that has been started. Our job is to pick out from the list below the columns additional words to write in each box. When we have done the sample item together, see whether you can do the same thing in items 9 and 10.

ITEM 8.

POLICEMAN	POLICEMAN	POLICEMAN	POLICEMAN
SHERIFF	DESK SERGEANT	CITY ENGINEER	AIRLINE HOSTESS
MARSHALL	STENOGRAPHER	FIREMAN	SAILOR

COP
CORONER
DOORMAN
NURSE
PLAINCLOTHESMAN
POSTMAN
TEACHER
TELEPHONE OPERATOR

The Convergent Production of Classes instrument included two questions of this type in addition to the sample item. The first included three boxes (classes to be completed) with eleven words to be matched to the classes, while the second item included four boxes with twelve words to be matched to items. In all there were twenty-three words to be matched to seven categories.

List Division: This is the classic Convergent Production of Classes task discussed above. The task is to create a specified number of classes from an array of words. Item 13 from the instrument is reproduced below.

ITEM 13.

CATEGORY I

CATEGORY II

CLUE
SUMMONS
FINGERPRINT
INTERROGATE
WARRANT
TICKET
LIE DETECTOR
SUBPOENA

The five items in the instrument included thirteen boxes in which forty-nine words were to be classified.

Crossword: The Crossword items required the arrangement of nine words into a matrix so that both rows and columns would constitute classes. For each item, six classes could be made by arranging the words properly in the matrix. Item 19 from the instrument is reproduced below.

ITEM 19.

ARMED FORCES
HIGHWAY PATROL
HORSE
JEEP
MILITARY POLICE
MOTORCYCLE
MOUNTED POLICE
NATION
STATE

Score points were assigned for each row or column which included the three words constituting any of the six classes built into the item. Twelve points were possible for the correct completion of both items.

Administration

The Convergent Production of Classes items were administered to the eighth grade subjects in two sessions one week apart. The Matching and Same-word Matching items were used during the first of these sessions and the List Division and Crossword during the second.

Scoring

For each subject, a separate score for each of the four types of items was obtained. These were determined by a count of the words classified as specified by the scoring key for the two types of matching items and for the List Division items. For the Crossword items the score was based on the number of classes arranged (rows or columns) correctly. A subject's total score was a figure equal to the sum of his points on the four types of items. A total score of 108 points was possible on the Convergent Production of Classes battery.

Distribution of Scores

Table 3-1 on the next page describes the performance of the subjects on the four kinds of items and on the total instrument.

TABLE 3-1

SUMMARY OF PERFORMANCE ON THE CONVERGENT PRODUCTION OF CLASSES BATTERY

Type of Item	(1) Number of Points Possible	(2) Extremes Low	High	(3) Mean	(4) SD
Matching	24	8	24(3)*	17.8	3.2
Same-Word (Matching)	23	0	17	8.4	4.0
List Division	49	12	49(2)	34.3	6.9
Crossword	12	1(2)	12(8)	7.5	3.0
Total	108	28	93	68.4	10.8

*The numeral enclosed in brackets indicates the number of subjects who achieved the score. Where no numeral appears, the score was obtained by only one subject.

There is evidence in column 2 that, with the exception of Same-word Matching, the items were not difficult enough to allow the abler students to differentiate themselves. Three subjects achieved perfect scores on the Matching items, two on the List Division items, and eight on the Crossword items. From an examination of the means and Standard Deviations it appears as though performance on the List Division tasks approximated normal distribution more nearly than did performance on the other tasks.

Comparisons Among the Four Types of Items

In part to introduce novelty into the research tasks for the subjects and in part to see whether items which differed from Guilford's classic list division format would tap the Convergent Production of Classes ability, three kinds of items were used in addition to List Division.

Because of the differences in length and in difficulty of the four kinds of items, intercorrelation among them are difficult to interpret, but they are instructive in some ways. Table 3-2 presents these intercorrelations.

TABLE 3-2

INTERCORRELATIONS OF TYPES OF ITEMS AND TOTAL SCORE FOR CONVERGENT PRODUCTION OF CLASSES[a]

Variable	Notation	X^1	X^2	X^3	X^4
Total points	Y	722	576	732	479
Matching	X^1	---	477	199	276
Same-word	X^2	477	---	181	014
List Division	X^3	199	181	---	200
Crossword	X^4	276	014	200	---

a. Decimal points omitted.

It can be seen that Matching and List Division correlated with approximately equal magnitude to the total score. Matching correlates higher with the Same-word Matching .477 and with Crossword .276 than it does with List Division .199. List Division does not correlate significantly with Same-word .181 nor with Crossword .200.

Another way to approach the question of whether these three types of items are measuring the same or different abilities is to correlate them with some criteria and compare these correlations. Test scores and teachers grades from the cumulative records can serve as such criteria. Table 3-3 presents these correlations.

TABLE 3-3

CORRELATIONS OF SUB-PARTS AND TOTAL SCORE ON THE CONVERGENT PRODUCTION OF CLASSES INSTRUMENT WITH CUMULATIVE RECORD VARIABLES[a]

	(1) Matching	(2) Same-Word	(3) List Division	(4) Cross-word	(5) Total
(1) Math GPA	188	305	253	272	413
(2) Reading GPA	270	212	324	402	498
(3) English GPA	227	210	338	431	494
(4) Spelling GPA	250	199	178	175	332
(5) History GPA	490	344	269	381	558
(6) Total GPA	361	327	326	421	567
(7) Language IQ	303	317	180	121	343
(8) Non-Language IQ	-218	115	067	135	-021
(9) Total IQ	012	246	191	161	181
(10) Read Vocab	600	375	314	213	530
(11) Read Comp	526	429	392	126	547
(12) Arith Reas	144	183	451	159	370
(13) Arith Fund	329	343	522	173	573
(14) Eng Mech	091	296	172	194	274
(15) Spelling	228	269	037	029	177

[a]Decimal points omitted.
Significance levels: .269 at .05; .348 at .01; .435 at .001.

Examining column 5 we are struck with the fact that the correlations between total score and the cumulative record variables are positive and significant with all measures except Non-language IQ, Total IQ and CAT Spelling. We may say, parenthetically, that whatever abilities are being tapped on this total score are related to academic performance. Our effort at this point, however, is to try to determine whether it is Convergent Production of Classes ability that accounts for these correlations or whether something else is more importantly involved. Turning our attention to column 1, row 10, on the table, we see a remarkably high correlation .600, between the Matching Score and CAT Reading Vocabulary. Row 11, column 1, shows a high correlation .526, also between Matching and Reading Comprehension. In order to examine the possibility that the very substantial correlation between our Convergent Production of Classes total score and these cumulative record measures may be reflecting largely vocabulary ability, the data are presented in another way. Table 3-4 presents the correlations between CAT Reading Vocabulary and the cumulative record variables side-by-side with the Convergent Production of Classes Total score, correlated with these same variables.

TABLE 3-4

COMPARISONS OF THE MAGNITUDE OF CORRELATIONS OF THREE VARIABLES (CPC-TOTAL SCORE; CPC-LIST DIVISION; CALIFORNIA ACHIEVEMENT TEST-READING VOCABULARY) WITH CUMULATIVE RECORD VARIABLES[a]

	(1) CPC List Division	(2) CAT Reading Vocabulary	(3) CPC Total
(1) Math GPA	253	410	413
(2) Reading GPA	324	441	498
(3) English GPA	338	449	494
(4) Spelling GPA	178	408	332
(5) History GPA	269	585	558
(6) Total GPA	326	552	567
(7) Language IQ	180	408	343
(8) Non-language IQ	067	-092	021
(9) Total IQ	191	150	181
(10) CAT Reading Vocabulary	314	---	530
(11) CAT Reading Comprehension	392	714	547
(12) CAT Arithmetic Reasoning	451	345	370
(13) CAT Arithmetic Fundamentals	522	543	573
(14) CAT English Mechanics	170	362	274
(15) CAT Spelling	037	280	177

[a]Decimal points omitted.
Significance levels: .269 at .05; .348 at .01; .435 at .001.

The similarity between the sets of correlations in columns 2 and 3 is striking, a fact which adds to our growing suspicion that the Matching items are more nearly measures of Structure of Intellect Units (vocabulary) than of Structure of Intellect Classes.

Now, turning our attention to column 1 and 2 we can compare the correlation between Convergent Production of Classes-List Division and the cumulative record variables to those with CAT Reading Vocabulary: Now we see substantial differences in several measures which seem to be dependent on vocabulary. The following correlations are substantially higher for CAT Reading Vocabulary than for List Division; Spelling GPA, History GPA, Language IQ, and Reading Comprehension. The reverse is true for Arithmetic Reasoning.

These scattered and unsystematic bits of data suggest that the Total Score is influenced by vocabulary to a greater extent than is the List Division Score and that we would be justified therefore, in retaining the List Division Score as the sole measure of Convergent Production of Classes.

To summarize, from an inventory of words written in response to the stimulus topic LAW by eighth grade subjects, college students who were in the teacher education program, formulated items designed to stimulate the kind of thinking hypothesized in the Structure of Intellect as Convergent Production of Classes. Four kinds of items were devised which have been called Matching, Same-word Matching, List Division, and Crossword.

An instrument, which involved the classification of 108 words in these various kinds of items, was prepared and administered to fifty-four eighth grade pupils in two testing sessions. The instruments were scored and the total scores were found to correlate positively and significantly with twelve of fifteen criteria measures of academic achievement. The highest correlations were found with Total Grade Point Average, CAT Reading Comprehension, and CAT Arithmetic Fundamentals.

Since one purpose of the study was to determine whether college students could design tasks which would stimulate students to utilize the Convergent Production of Classes ability, an attempt was made to see whether the items designed were in fact tapping classification ability or were largely measures of vocabulary. The List Division task which is similar in format to that used by Guilford in isolating the factor did not correlate significantly with any of the other types of items in the instrument and did not correlate as high with criteria measures depending strongly on vocabulary as did the total score. It was concluded that the List Division Score was less dependent on vocabulary ability and, therefore, more nearly a manifestation of classification ability than was the total score and should be used as the measure of Convergent Production of Classes throughout the remainder of this report. Convergent Production of Classes--List Division, correlated positively and significantly, but not highly, with Grade Point Average, with CAT Reading Vocabulary, and CAT Reading Comprehension. The magnitude of the correlation was highest, however, with CAT Arithmetic Reasoning (.451) and CAT Arithmetic Fundamentals (.522).

MEMORY OF CLASSES

Definitions

Memory: "Retention or storage, with some degree of availibility, of information in the same form it was committed to storage and in response to the same cues in connection with which it was learned.

Classes: "Conceptions underlying sets of items of information grouped by virtue of their common property."[1]

Operational definition-Memory of Classes: From an array of items which have previously been learned as categories, sets or classes, sharing a common property or because they are subordinated to a common superordinate heading, reproduce the original categories, sets, or classes.

Preparation of the Instrument

Using words originally produced by the subjects themselves during the Divergent Production of Units task, and working with the format of a skeleton item which included only the instructions for the task, college students created a number of items. From among those prepared by college students, the project staff selected the one judged to be most promising. After some refinements, the item was reproduced for administration to the subjects.

Administration of the Memory of Classes Task

In order to design a task consistent with the definition of Memory of Classes, it was necessary to teach or present material which could be learned as classes at one time so that it could be reproduced as remembered at a subsequent time. This was accomplished by introducing the material to be remembered at the close of one data gathering session and having it reproduced as remembered at the beginning of the next data gathering session one week later.

The Instruction Phase

The teaching part of the sequence was accomplished by means of a modified recitation procedure in which the investigator assumed the teacher role. The Memory of Classes instrument was distributed to the subjects and five large squares or boxes were drawn on the chalk board. The instructions and the words to be classified in this task are reproduced on the next page.

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[1] Guilford, J. P. & Hoepfner, R., "Structure of Intellect Factors and their Tests, 1966." Aptitudes Research Project Publications, No. 37. University of Southern California, Department of Psychology.

Instructions: We will work this item together. Pick out from among the words in the list the five words which you think will make the best headings under which to categorize other words in the list. Write each heading-word you decide on at the top of one of the squares below. Now, write each of the other words from the list in the square with the appropriate heading. Use each word only once.

ITEM 11.

ARREST
ATTORNEY
CONGRESS
CORRECTION
COURT
DETECTION
ENFORCEMENT
FINE
FINGERPRINT
GUN
HIGHWAY PATROL
INVESTIGATOR
JUDGE
JUDICIAL SYSTEM
LEGISLATION
LIE DETECTOR
MEDICARE
POLICEMAN
PAROLE
PRISON
PROBATION
SENATOR
STATUTE
SURVEILANCE
TRIAL

The subjects were asked to read the instructions from their papers as the investigator read them aloud. Conducting a recitation type interaction with the subjects, the investigator asked who could pick a word from the list that would make a good heading for one of the boxes. The subjects volunteered by raising their hands and the investigator called on them one at a time for suggestions. When a suggestion was correct as predetermined by the scoring key, the investigator wrote it in one of the boxes on the chalk board and instructed the subjects to write the word on their individual answer sheets in the same manner. This procedure was continued until all heading words had been identified and written in the appropriate boxes on the chalk board and by the subjects on their own papers. Following this step, the remaining words on the list were classified under the appropriate headings through a continuation of the recitation type interaction, each word, in turn, being written both on the chalk board by the investigator and on individual answer sheets by the subjects themselves. The interaction was conducted in an informal manner allowing for clarification of terms and including the rationale for classification when this appeared to be needed.

When all subjects had written the words on their answer sheets, the sheets were collected. The subjects were not informed that they would be asked to reproduce this classification system at a later date.[1]

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[1] See Appendix Page 66, for copy of Memory of Classes Item.

The Reproduction Phase

One week after the instruction phase described above, at the beginning of the data gathering session, the Memory of Classes instrument was distributed again. The investigator asked the subjects whether they had seen the item before and reinforced their impression that it was the same list of words they had classified into the boxes on the chalk board the week before. The procedure followed in the instruction phase was reviewed--"first, five heading words were selected and written at the top of the five boxes; next, each of the remaining words was written into the box with the most appropriate heading word." When it appeared that all subjects had recalled the procedure, the investigator asked them to try to remember how the words had been classified and to write them in the boxes exactly as they had been written the week before.

The subjects were given as much time to complete the task as they needed, and when all had finished writing all words into the boxes the sheets were collected.

Treatment of the Data

It was intended that a subject's performance on the task would be scored on the basis of the number of words classified as they had been classified during the instructional phase of the sequence. It became obvious immediately upon glancing at the answer sheets that scoring would not be a simple process because some subjects did not remember which words had been designated as heading words. Therefore, it became necessary as a first step in treating the responses to create some convention for scoring those classes which did not include one of the categories as a heading. The following instructions were prepared for rating the responses:

(a) Inspect the class to see whether a category heading word is included with at least two other words classified with it in the scoring key. If so, tally the class according to that category.

(b) If none of the five categories appears as a word in the class but at least three words are listed together as in the scoring key, tally under the category in which the words are found in the scoring key.

(c) If a class does not contain at least three words classified as in the scoring key, do not tally, because no points are possible.

A scoring sheet, arranged in five columns was devised. The columns were headed:

Legislation
Judicial System
Correction
Enforcement
Detection

Each column was subdivided as on the next page:

Heading Word		Sub-word		Number of words incorrectly placed
Correct	As sub-word	Number correct	As heading	
( )	( )	( )	( )	( )

By way of illustration, a class consisting of the following words, (COURT, ARREST, FINGERPRINT, TRIAL, ATTORNEY) would be tallied under the category Judicial System with no notation in the heading word column, two words (TRIAL and ATTORNEY) as "sub-words correct", one word (COURT) under "sub-word, as heading" and two words incorrectly placed (ARREST, FINGERPRINT).

From such a tally, a count was made of the number of heading words correctly designated and of the number of sub-words correctly designated under each category for the entire sample. Since there were fifty-four subjects the maximum possible number of correct placements of "heading words" for each category was fifty-four. There were four sub-words for each category. For 54 subjects combined the maximum number of correct placements for sub-words was 216. If all subjects had correctly placed all five words in a category the maximum total for any category for the sample would have been 270. Table 3-1 below summarizes the actual number of words correctly placed as heading words, as sub words, and in column 3, the sum of these two columns. In addition, the table indicates the percent of total possible correctly placed and the means per individual subject.

TABLE 4-1

SUMMARY OF NUMBER AND PERCENT OF CORRECT PLACEMENTS AND MEAN NUMBER REMEMBERED PER SUBJECT ON THE MEMORY OF CLASSES TASK

	Heading Words Correct		Sub Words Correct		Combined		Mean per Subject
	Number	Percent	Number	Percent	Number	Percent	
Legislation	33	61	113	53	146	54	2.7
Judicial System	35	65	137	63	172	64	3.2
Correction	37	69	135	63	172	64	3.2
Enforcement	41	5	127	59	168	62	3.1
Detection	37	69	131	61	168	62	3.1
Total	183	68	643	60	826	61	15.3

Inspection of the table reveals that the word ENFORCEMENT was remembered as being a heading word by more subjects than the other four, and LEGISLATION was remembered by the fewest number, about a 15% difference. Also, column 2 reveals that there were fewer sub words correctly placed in the LEGISLATION category than in the others. Column 4 of the table shows that slightly more than 15 out of the 25 words were correctly placed on the average. It is very difficult to interpret these figures because one cannot know for sure whether subjects who placed the words correctly did so because they "remembered" from the instruction phase or because they "classified" from their knowledge of the words and their attributes. Examination of some of the responses has suggested that the subjects could not possibly have done so poorly on the task if they had been trying to classify rather than trying to remember.

Scoring

It was possible to make three kinds of errors on the memory of classes task: to include heading words in a category as a sub word; to designate a sub word as the heading word; and to place words in the wrong category. A scoring system was devised in which two points were given for words correctly placed as either heading words or as sub words and one point for words in the appropriate category but incorrectly placed as to heading/sub word designation. From this total in any category, one point was subtracted for each word incorrectly placed in the category. With this formula a score could be obtained for the subjects on each category and on the total item. The highest possible score for a subject for each category was ten points and for the entire item, fifty points.

TABLE 4-2

NUMBER OF SUBJECTS ACHIEVING NO POINTS OR PERFECT POINT SCORES FOR EACH CATEGORY AND MEANS AND S.D. FOR EACH CATEGORY

	Points for individual subjects					
	Extremes				Mean	
	Low	N	High	N	Points	S.D.
(1) Legislation	0	(6)	10	(5)	5.1	2.9
(2) Judicial System	0	(5)	10	(10)	5.7	3.2
(3) Correction	0	(10)	10	(10)	5.9	3.4
(4) Enforcement	0	(8)	10	(8)	5.3	3.2
(5) Detection	0	(5)	10	(8)	5.7	2.9
(6) Total	0	(1)	50	(2)	27.7	11.8

Note - The numerals in brackets indicate the number of subjects who achieved the score.

Reading across Row 1, of Table 4-2, we see that for the category of LEGISLATION, zero points were achieved by 6 subjects, and perfect scores, ten points, by five subjects. Mean points on this category 5.1, S.D. 2.9. The category of CORRECTION was apparently most difficult for some subjects, ten receiving no points, and the easiest for some subjects, ten receiving perfect scores for the category. The mean for the category was 5.9, highest among the five categories.

Row 6 on the table reports that one subject received no points on the entire item and two subjects received perfect scores of 50 points. These extremes are greater than on any task in the entire study.

Table 4-3 below reports the intercorrelations between the five categories and the total memory score.

TABLE 4-3

INTERCORRELATIONS OF CATEGORIES AND TOTAL SCORE ON MEMORY OF CLASSES[a]

Variables	Notation	X^1	X^2	X^3	X^4	X^5
Total Points	Y	723	828	780	708	818
Legislation	x^1	---	518	579	463	577
Judicial System	x^2	518	---	295	437	354
Correction	x^3	579	295	---	478	619
Enforcement	x^4	463	437	478	---	488
Detection	x^5	577	345	619	488	---

[a] Decimal points omitted.

Row 1 shows that the five categories contributed about equally to the total score. The magnitude of the correlations in this table are not high enough to give assurance that there is a memory ability at work which is more completely responsible for the scores than some other factor. The correlations between the JUDICIAL category and the other four categories are noticeably lower than most of the other intercorrelations; with CORRECTION .295, with ENFORCEMENT, .437, and with DETECTION, .345, suggesting that performance on this category was less dependent on memory from the instructional phase than was true for the other categories. Apparently the words (ATTORNEY, COURT, JUDGE, TRIAL) were known to the subjects as related to the JUDICIAL system. The consistently highest intercorrelations are with the category of LEGISLATION in which the words to be classified included (CONGRESS, MEDICARE, SENATOR, STATUTE). It may be that the words MEDICARE and STATUTE were little known by many students until the instructional phase and could have been placed correctly only on the basis of memory.

Relationships between Memory of Classes Score and Cumulative Record Variables

Table 4-4 on the next page presents the correlations between the 15 aptitude and achievement variables and the Memory of Classes Total Score. It will be noted that 11 of the correlations are significant.

TABLE 4-4

CORRELATIONS OF MEMORY OF CLASSES SCORES WITH CUMULATIVE RECORD VARIABLES[a]

	Points Total
Math Grade Point Average	371*
Reading Grade Point Average	275
English Grade Point Average	379
Spelling Grade Point Average	323
History Grade Point Average	492
Total Grade Point Average	424
CTMM Language IQ	216
CTMM Non-language IQ	120
CTMM Total IQ	201
Reading Vocabulary CAT	518
Reading Comprehension CAT	470
Arithmetic Reasoning CAT	324
Arithmetic Fundamentals CAT	437
English Mechanics CAT	403
Spelling CAT	245

* Significance levels: .269 at .05; .348 at .01; .435 at .001.

[a] Decimal points omitted.

Because of the nature of the task, it is impossible to know the extent to which memory from the instructional phase of our procedure influenced the scores on the item. On Table 4-4 we find the typically sizable correlations with CAT Vocabulary (.518), Reading Comprehension (.470) and Arithmetic Fundamentals (.437). The memory ability--memory of words and their attributes--as involved in all classification tasks, is undoubtedly involved in this task as well, but nothing in Table 4-4 suggests that a Memory of Classes ability was tapped.

It is probably that our task does not really qualify as a memory of classes item because the words included in the item already had meaning for the subjects. Some subjects may have been able to do a better job of classifying if there had been no instructional phase. As far as we can determine, strict memory of classes is appropriate only when groupings are arbitrary--not based on intrinsic commonality. The only excuse we can think of for requiring students to learn meaningful material as classes so that it can be reproduced as classes, is as an interim device during the learning of a complex system of interrelated classes when the instructor feels he must use super-ordinate and sub-ordinate terminology before the students thoroughly understand the concepts involved or the relationships between them.

On the other hand, if the process of remembering a new name or word for a class of items which is already meaningful to the learner can be considered Memory of Classes, the ability would figure importantly in instruction as contributing to concept attainment or vocabulary building.

COGNITION OF CLASSES

Definitions

Cognition: "Immediate discovery, awareness, rediscovery, or recognition of information in various forms: comprehension, understanding."

Classes: "Conceptions underlying sets of items of information grouped by virtue of their common property."[1]

Operational definition-Cognition of Classes: Immediate discovery, awareness or recognition of the commonality which is shared by several items of information that are presented as a category, set, or class.

Preparation of Instrument

To be consistent with the above operational definition, the items for a Cognition of Classes instrument must include an array of words which share one or more common attributes--which can be seen as constituting a class. The intellectual task for the subject is to demonstrate that he recognizes or comprehends the class. The simplest format, the one used by Guilford in isolating the factor, requires only that a fourth word which does not share the common attribute be added to the array of words. The subject demonstrates that he recognizes or comprehends the class by picking out the word which does not belong.

The inventory of words from which the items were composed was the master list of over 400 words written by the eighth grade subjects in response to the stimulus topic LAW. College students in the teacher education program who designed the items first created a quantity of three-word classes using the words in the inventory. Next, they attempted to find distractor words for each item that shared a common attribute, (an attribute different from the one which constituted the commonality among the original three words) with one or two of the original words, but not with all three.

From among the items prepared by the college students, eighty were selected for inclusion in the instrument. Sixty items carried the instructions "Circle the word that does not belong" and are referred to in this report as deletion items. Twenty additional items carried the instructions, "Pick out the word that would make the best heading for the other three." These are referred to as PICK-A-Heading items. An instrument of 80 items was administered to the subjects.[2]

Administration of the Instrument

The Cognition of Classes data were gathered from the eighth grade subjects on the fourth of five data gathering sessions. In the preceding weeks the subjects had completed the DPU, DPC, CPC, and Memory tasks described in the preceding sections of this report.

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[1] Guilford, J. P. & Hoepfner, R., "Structure of Intellect Factors and Their Tests, 1966" Aptitudes Research Project Publications Number 37, University of Southern California, Department of Psychology.

[2] See Appendix Pages 67-69, for copy of Cognition of Classes instrument.

Analysis of Responses

Deletion Items: In an effort to discover, in a very general way, how much challenge the items seemed to offer to the subjects, a tally was made of the number of subjects choosing a wrong alternative on each item. The results of this tally are reported in Table 5-1 below in the form of a frequency distribution.

TABLE 5-1

RANGE OF DIFFICULTY OF DELETION ITEMS
ON COGNITION OF CLASSES INSTRUMENT

Number of Items	Frequency of Incorrect Responses
10	0---9
15	10--19
17	20--29
13	30--39
5	40--49
TOTAL 60	

This table should be read as follows: Ten of the 60 items were answered incorrectly by fewer than ten subjects; fifteen items were answered incorrectly by between ten and 19 subjects, etc.

No item was answered correctly or incorrectly by all subjects.

By way of illustration, a few of the items at the extremes of the continuum of difficulty are reproduced in Table 5-2 below.

TABLE 5-2
EXAMPLES OF ITEMS AT THE EXTREMES OF DIFFICULTY
ON COGNITION OF CLASSES INSTRUMENT

Item #	Words in the Item	Number Omitting	Number Missing
2	(OUTLAW) (BANDIT) (IN-LAW*) (CRIMINAL)	0	1
4	(KING) (PEOPLE*) (PRESIDENT) (PRINCIPAL)	1	1
18	(CONGRESSMAN) (REPRESENTATIVE) (JUDGE*) (SENATOR)	2	2
44	(ANARCHY*) (DEMOCRACY) (COMMUNISM) (TYRANNY)	2	46
60	(AWARD) (DELIBERATE*) (JUDGMENT) (SENTENCE)	2	47
17	(AMENDMENT) (BILL OF RIGHTS*) (LAW) (STATUTE)	0	46

* Correct answer

A cursory examination of the items in the table which were answered incorrectly by such a large number of subjects raises the question as to whether the fault lay with the items themselves rather than with the eighth graders. An inspection of the answer sheets of the subjects who scored highest on the entire instrument revealed that they had answered the items correctly more often than the subjects who scored lowest on the instrument, but the differences were not great. Our impression, after having studied the responses of the subjects to the items, was that many of the items could have been improved.

PICK-A-HEADING Items: Twenty items were selected for the instrument which instructed the subject to pick one of the four words that would make the best heading for the other three. By way of illustration, item number 18, from the instrument, is reproduced below. This item was answered incorrectly by 32 subjects:

18. ASSEMBLYMAN
LEGISLATOR*
REPRESENTATIVE
SENATOR

No item was answered correctly or incorrectly by all subjects.

Scoring

One point was assigned to each item answered correctly. The scores were recorded on the two kinds of items separately and combined for a total score for each subject. The scores for the sample are summarized on Table 5-3 below.

TABLE 5-3

SUMMARY OF SCORES FOR THE COGNITION OF CLASSES INSTRUMENT

Type of Item	# of Points Possible	Extremes		Mean	SD
		Low	High		
DELETION	60	21	51	33.6	5.6
PICK-A-HEADING	20	5	20	15.4	2.5
TOTAL	80	33	70	49.0	7.1

It will be noted that the subjects seemed to find the PICK-A-HEADING items easier than the DELETION items. To the extent that this reflects a real rather than a chance difference in the difficulty of the two types of items it could be accounted for by the fact that the PICK-A-HEADING items include more cues than do the DELETION items. One could not predict the existence of such a difference in difficulty on the basis of these sparse data, but might do so on the basis of the nature of the items themselves. The DELETION items give no clue whatsoever as to the kind of attribute three of the words have in common while the PICK-A-HEADING instructions may suggest to the subject that the attribute is one of level of abstraction. The coefficient of correlation for the two parts is .539. The coefficient of correlation for the DELETION score with total score was reported as 1.00 which appears from an inspection of the actual scores to be somewhat in error. The correlation of total score with PICK-A-HEADING was .840.

Again, as was the case with Convergent Production of Classes, it appears as though when one tampers with the format used by Guilford in isolating the factors, he runs the risk of changing the Structure of Intellect product with which he is dealing.

TABLE 5-4

CORRELATION OF COGNITION OF CLASSES SCORES WITH CUMULATIVE RECORD VARIABLES[a]

	Deletion	Pick-A-Heading	Total
Math GPA	519	386	550
Reading GPA	402	228	443
English GPA	427	297	481
Spelling GPA	337	064	320
History GPA	628	435	686
Total GPA	550	308	603
Language IQ	277	269	259
Non-language IQ	-024	-063	-096
Total IQ	200	103	091
CAT Reading Vocabulary	440	549	482
CAT Reading Comprehension	635	522	612
CAT Arithmetic Reasoning	393	303	388
CAT Arithmetic Fundamentals	437	298	453
CAT English Mechanics	160	213	158
CAT Spelling	071	040	000

[a] Decimal points are omitted.
Significance levels: .269 at .05; .348 at .01; .435 at .001.

Table 5-4 above, presents correlations between the two types of cognition items, the total score and the variables from cumulative records. turning attention first to a comparison of the magnitude of the correlations of the two types of items and the cumulative record variables, we see that in all but one instance the DELETION scores correlate higher. The one exception to this is the correlation of .549 with PICK-A-HEADING and CAT Reading Vocabulary. Consistently throughout the data in this report, we find that as the classification items are altered to include more cues correlations with vocabulary go up, suggesting that we have, to an extent, made our items more nearly SI Units (vocabulary) and less clearly SI Classes.[1]

Of the 45 correlations in the array on Table 5-4, 30 are significant and several are impressive, indicating that Cognition of Classes, as this study has tapped the ability, is related to school achievement. The meaning of these correlations will be discussed in a subsequent section of this report in which the several SI Operations are compared.

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[1] This is an extremely important point. College students and teachers who design exercises to elicit classification behavior seem compelled to include many cues. Evidently when they do, the special potential of the classification task is lost.

EVALUATION OF CLASSES

Definitions

Evaluation: "Reaching decisions or making judgments concerning criterion satisfaction (correctness, suitability, adequacy, desirability, etc.) of information.

Classes: "Conceptions underlying sets of items of information grouped by virtue of their common property."[1]

Operational definition-Evaluation of Classes: When the commonality shared by a set of items is designated as the criterion, make a judgment as to which of two alternative choices best satisfies the criterion, i.e., best fits into the set.

Preparation of the Instrument

The Operational definition for Evaluation of Classes specifies that the criterion to be used in the making of judgments about classes is to be the attribute shared by the items in a class--the common attribute shared by a set of items. Once this decision is made, one realizes that, in a sense, most of the classification tasks devised for this study involve evaluation of classes--using a common attribute as a criteria for making judgments. Since the emphasis in this phase of data gathering was to be on the criterion, rather than on the judgment, a technique was utilized which required the subject to articulate the criterion on which his classification decisions were based.[2]

Using the words originally associated to the stimulus topic LAW by the eighth grade subjects, college students prepared a quantity of items. Each item consisted of a three-word class together with two alternative words from which the subject was to make a judgment as to which fit better with the other three to make a good class or category. An example from the instrument is reproduced below.

1.	LAWYER	(A) COURT REPORTER
	JUDGE	(B) JURY BOX
	BAILIFF	

Following the making of the judgment, the subject was asked to communicate the reasons for his choice. The instrument consisted of 50 items.[3] Consistent with our attempt to emphasize the criterion underlying each choice, the interview technique was used in data collection.

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[1] Guilford, J. P., & Hoepfner, R., "Structure of Intellect Factors and Their Tests, 1966." Aptitudes Research Project Publications, Number 37, University of Southern California, Department of Psychology.

[2] In retrospect, it appears as though our items for the operation of Evaluation should have required the subject to make a judgment as to which of two classes was better. One of each pair could have included items which more nearly satisfied the criteria for a good class described in the section of this report dealing with Divergent Production of Classes-Quality.

[3] See Appendix Page 70, for a copy of the Evaluation of Classes Instrument.

Data Collection-Interviews

The interviews were conducted by the college students who had been involved in building the instruments utilized in previous phases of this study. The data were gathered in two sessions. One-half of the subjects were interviewed during one hour by one group of interviewers and the other half of the subjects were interviewed immediately following by a second group of interviewers. One interviewer and one subject occupied a double desk in a large classroom. Thus, approximately 27 interviews were being conducted in the same classroom at the same time.

The subject and the interviewer each had a copy of the items. In addition, the interviewer had an answer sheet on which to record the subject's responses. The interviewers read the three words in the item aloud as the subject studied the printed item. Then the interviewer asked, "Does (A) COURT REPORTER, or (B) JURY BOX, fit best with these other three words to make a four-word category?" If the subject seemed to be reluctant to make a judgment, the interviewer encouraged him to try even if he wasn't sure of the answer. After the subject had made his choice between the alternatives, the interviewer asked him to give the reasons for his choice: "Can you tell me why you chose that one?" The subject's response was recorded verbatim on the interviewer's answer sheet, and if the interviewer felt there was reason to do so, he would probe with the standard, "Tell me a little more about it."

Treatment of the Data

In order to be able to assess the effectiveness of the technique with eighth graders and to get some feel for how the items themselves worked out, each answer sheet was treated as follows. For each item, the following notations were made: (a) Judgment attempted or not; (b) judgment correct or incorrect; (c) acceptable criterion statement present or absent. A sheet was prepared on which the above information about the items could be tallied and summarized and percentages calculated. With such information it was possible, in addition, to compute a "Criterion Difficulty" score for each item. This information is reported in Table 6-1. By way of illustration, the figures describing item "1" from the instrument would be interpreted as follows: Item "1". Number making a judgment, 54 (100%); Correct choices, 42 (78% of those attempting); Acceptable criterion present, 31, (74% of number making correct choice); Criterion Difficulty, percent of persons making correct judgment who supplied acceptable criterion statement subtracted from 100% (100 - 76 = 26). Twenty-six percent of the subjects who made the correct judgment were unable to supply an acceptable criterion.

TABLE 6-1

DIFFICULTY LEVEL OF ITEMS ON EVALUATION OF CLASSES INSTRUMENT

Item Number	(1) Subjects Making Judgments N	%	(2) Correct Judgments N	% of attempts	(3) Acceptable Criterion Statement N	% of correct	(4) Criterion Difficulty*
1	54	100	42	78	31	74	26
2	52	96	43	83	33	77	23
3	54	100	53	98	48	90	10
4	52	96	48	92	36	69	31
5	50	93	11	22	21	—	—
6	50	93	40	80	27	68	32
7	48	89	44	91	39	89	11
8	47	87	44	94	23	52	48
9	53	98	44	83	31	70	30
10	45	83	44	97	10	23	77
11	52	96	42	81	33	79	21
12	50	93	47	94	35	74	26
13	49	91	47	96	21	45	55
14	48	89	39	81	21	54	46
15	46	85	35	76	27	77	23
16	44	81	37	84	29	78	22
17	46	85	45	98	37	79	21
18	38	70	36	95	11	31	69
19	44	81	24	55	21	88	22
20	42	78	31	74	22	71	29
21	43	80	25	58	7	28	72
22	38	70	33	87	25	76	24
23	29	54	28	97	18	64	36
24	28	52	18	64	3	17	83
25	26	48	17	65	17	100	0
26	25	46	20	80	5	25	75
27	19	35	10	52	9	90	10
28	17	31	10	59	2	20	80
29	15	28	9	60	3	33	66
30	13	24	13	100	7	54	46
31	12	22	7	58	3	53	47
32	10	19	7	70	3	53	47
33	8	15	7	87	6	86	14
34	5	9	3	60	0	0	100
35	5	9	3	60	2	67	33
			TOTAL	2709		2054	1355
			MEAN	77%		60%	39%

* Percent in column 3 subtracted from 100.

The first column in Table 6-1 illustrates why it was necessary to use "percent correct of items attempted" in our descriptions of item difficulty. Column 1, shows that the percentage of subjects attempting the items remained fairly constant through item #22. Thereafter, the percent attempting the item declines consistently suggesting that time was a limiting factor.

Summarizing from the information on Table 6-1, but without much attention to detail, several generalizations can be made about the items. First, the correct alternatives in the items were rather easy to spot for the eighth grade subjects. On the average, 77% of their judgments were correct, and on only one item did the percent of correct choices fall below 50. Second, it was difficult for the subjects to articulate an acceptable rationale even for judgments which were correct. On the average, they could supply acceptable statements of criteria for only 60% of their correct judgments. Third, the items differed greatly one from another in the difficulty subjects found in stating acceptable criteria. On item #10, for example, 77% of the subjects who made correct judgments could supply no acceptable rationale for their judgments, while on item #25, all subjects who made the correct judgment were able to supply acceptable criteria.

Scoring

A subject's total score was based on the number of correct judgments plus the number of points assigned to his statements of criteria. Criteria statements were scored "2" points for good statements, "1" point for fair statements, and "0" points for statements considered to be inadequate. Two examples follow.

Item 1. LAWYER (A) COURT REPORTER
JUDGE (B) JURY BOX
BAILIFF

Statement of Criterion:

"0" Points - "All are in a court room."
"1" Points - "These are people."
"2" Points - "People who have special jobs to do in a trial."

Item 33. PARDON (A) OUT ON BAIL
PAROLE (B) SUSPENDED SENTENCE
PROBATION

Statement of Criterion:

"0" Points - "Suspended sentence seems to fit better."
"1" Points - "Out of prison."
"2" Points - "Free after conviction."

A maximum of three points could be earned for a single item--one point if the correct judgment was made plus one or two points for the criterion.

Each subject's protocol was treated to yield seven scores as follows: (1) Number of items attempted; (2) Number of correct choices; (3) Number of correct choices supported by criterion points; (4) Number of correct choices unsupported by criterion points; (5) Total criterion points; (6) Total score (which represents the sum of correct judgments plus the total criterion points); and (7) Mean points per item, computed by dividing the total score by the number of items attempted.

These data are summarized for the sample on Table 6-2 below.

TABLE 6-2

SUMMARY OF SCORES ON EVALUATION OF CLASSES INSTRUMENT

	Extremes			
	Low	High	Mean	SD
(1) Number of Items attempted	11	35	23.3	5.8
(2) Number of correct choices	6	29	18.6	5.0
(3) Number of correct choices with criterion points	4	20	12.5	4.2
(4) Number of correct choices without criterion points	2	18	6.1	3.4
(5) Total criterion points	6	35	20.5	6.7
(6) Total points	12	59	39.1	11.0
(7) Mean points per item	0.71	2.24	1.7	.3

Table 6-2 shows some interesting differences in style within this group of eighth graders. In row 1, the slow or fearful child who is willing to attempt only eleven items and the uninhibited or confident child who breezes through 35 items in the same period of time. In row 2, we see a child who makes only six correct judgments although, as we have shown in our item analysis, the items are quite easy for most of the subjects. Of most interest, however, is row 4, in which we see one child getting 18 correct judgments for which he is unable to give acceptable statements of criteria, and row 5, in which a child, on the entire task is able to supply statements of criteria judged to be worth only six points.

Comparison of Evaluation of Classes Scores to Cumulative Record Variables

Correlations between the Evaluation of Classes scores and the cumulative record variables are reported in Table 6-3 on the next page.

TABLE 6-3

CORRELATIONS OF SCORES ON EVALUATION OF CLASSES WITH CUMULATIVE RECORD VARIABLES[a]

	(1) # Items Attempted	(2) # Items Correct	(3) # Correct with Criteria	(4) # Correct without criteria	(5) Total criteria points	(6) Total points	(7) Mean points per item
(1)Math GPA	056	153	328	-182	308	267	159
(2)Reading GPA	044	030	249	-224	270	198	141
(3)English GPA	-036	-020	217	-276	228	144	104
(4)Spelling GPA	-099	-089	102	-271	182	078	174
(5)History GPA	181	188	324	-097	357	318	136
(6)Total GPA	051	046	280	-225	281	230	174
(7)Language IQ	-230	-030	199	-303	253	028	213
(8)Non-language IQ	-107	022	049	-047	013	-041	-045
(9)Total IQ	-193	000	125	-185	131	029	086
(10)CAT Read Vocab	123	211	269	-041	365	255	195
(11)CAT Read Compre	-017	064	265	241	355	226	282
(12)CAT Arith Reas	149	127	224	-093	193	189	005
(13)CAT Arith Fund	072	063	260	-218	288	212	073
(14)CAT Eng Mech	-298	-268	-013	-396	033	-124	073
(15)CAT Spelling	-386	-358	-128	-384	-028	-216	092

[a] Decimal points omitted.
Significance levels: .269 at .05; .348 at .01; .435 at .001.

Three of the columns in Table 6-3 are particularly instructive. Columns 1, 2, and 4, all reflect volume of output; all have a number of negative coefficients; and all are based entirely on the making of a simple two-alternative judgment--selecting alternative A or B in the Evaluation of Classes instrument. It would appear that the task designed to elicit evaluation behavior has been relatively successful as a device for allowing the opposite tendency to manifest itself. Columns 1 and 2 reflect correlations with Evaluation of Classes scores in which quantity of output contributes to the score and ability to supply criteria may or may not be present. Column 4, on the other hand, reflects correlations with Evaluation of Classes scores in which the judgment was correct, but criterion points were missing. In this column all correlations are negative (many significantly so), except for a correlation with CAT Reading Comprehension (.241). We can only speculate that tasks which allow a subject to answer with a "this or that" "yes or no" answer may be one way of allowing the typically poor student to demonstrate some ability. Its strength, if indeed it has any, may lie in the hope that through having made a correct judgment in this rapid fire kind of task, such pupils gain a little respect for themselves.

Reading across the table in rows 14 and 15, we see negative correlations with CAT English and CAT Spelling in nearly all columns. These negative correlations obtain to some extent with all scores except those in which quantity of output is either nullified as in column 7 (Mean Points per Item) or minimized in column 5 (Total Criterion points). To the extent that these correlations represent a real relationship between the variables, one could hypothesize that whatever personality or intellectual characteristics contribute to making judgments quickly apparently are antithetical to the kinds of characteristics required to master English Mechanics and Spelling.

When we turn our attention to column 5 (Total Criterion points), we find a rather dramatic shift from negative to positive correlations. It will be recalled that the Total Criterion point score includes only the points assigned for the criterion statements and does not include a point for having made the correct judgment on the items. Quantity of output influences the score only as the subject is able to attempt a greater number of items for which he can supply criteria to support his judgments. We can see that this distinction is important by comparing the correlations in this column, column 5, to those in column 7 (Mean points per item) where quantity has been ruled out entirely. In column 7, the correlations are mostly positive, but none reaches significance. The difference between these two columns can be summarized by saying that the ability to make judgments and supply acceptable criteria for a number of judgments is more apt to be related to school achievement than is the tendency to confine oneself to making only those judgments for which one can make especially good statements of criteria.

The ability to supply acceptable statements of criteria to a relatively large number of judgments is related to grade point average in math and history and to achievement test scores in Reading Vocabulary, Reading Comprehension, and to Arithmetic Fundamentals.

Turning attention to column 6 on Table 6-3, we find that the Total points score, which includes both criteria points and points for number of correct judgments, does not correlate significantly with any variable except History GPA.

By way of summary, it appears as though the Evaluation of Classes task devised for this study was poorly conceived except as it has illuminated some problems inherent in the very process of making judgments. When one habitually makes judgments quickly, he may find that he cannot defend them with a reasonable rationale even when they are correct. It may be, for pupils with whom this kind of pattern is established, the teacher's effort should be bent toward a kind of exercise in which the pupil's judgment must be postponed until after he has forced himself to articulate the criterion on which it is to be based. For Evaluation of Classes, this might mean presenting items of information grouped together, asking the student to specify what the grouping criterion appears to be, and then asking him to make a judgment as to which of the two alternatives best fits the criterion.

THE OPERATIONS COMPARED

In preceding sections of this report, each operation has been discussed independently and all except DPC-Quan have been shown to be related to school achievement. Certain scores from the various instruments described in the previous section have been selected for use in this section because they appeared to be relatively less dependent upon vocabulary or because they appeared more nearly to be consistent with Structure of Intellect definitions. Intercorrelations among these selected scores from among the classification instruments are reported in Table 7-1.

TABLE 7-1

INTERCORRELATIONS AMONG THE SEVERAL OPERATIONS

Variable	Notation	x^1	x^2	x^3	x^4	x^5
(1) Divergent Prod. Classes-Quan	x^1	----	.032	.014	.055	.012
(2) Convergent Prod. of Classes-List Division	x^2	.032	----	.302	.173	.282
(3) Cognition of Classes-Total	x^3	.014	.302	----	.443	.452
(4) Memory of Classes-Total	x^4	.055	.173	.443	----	.246
(5) Evaluation of Classes-Criterion Points	x^5	.012	.282	.452	.246	----

All correlations on the table are positive. In the first row, we see that DPC-Quan apparently is not related to any of the other scores, a fact which leaves us with a very serious question as to whether the task utilized in this study, when scored only for quantity, is a measure of the product, classes. We may say parenthetically that there is evidence in the data, not discussed elsewhere in this report, that the DPC-Quan score is a measure of Divergent Production since it correlates substantially (.554) with the Divergent Production of Units score (the total number of words written by the subject in response to the topic LAW). We can conclude from the correlations on Table 7-1 that DPC-Quan is unrelated to any other classification ability measured in the study.

The Cognition of Classes score in row 3, on the other hand, is correlated significantly with all classification tasks except DPC-Quan, suggesting that the ability to cognize classes is basic to all classification when quality is considered. All other correlations on the table are between .173 and .282. This array of intercorrelations lends support to the generalization that classification ability, regardless of the operation utilized to elicit it, rests first on the ability to recognize, grasp or comprehend a class. Beyond this, the operations are relatively independent of one another.

It may be instructive to bring together into one table an array of correlations which makes it possible to compare the magnitude of the correlations between the several operations and selected variables from the cumulative records. Table 7-2 presents such an array.

TABLE 7-2

CORRELATIONS BETWEEN THE SEVERAL OPERATIONS AND SELECTED VARIABLES FROM THE CUMULATIVE RECORDS[a]

	(1) DPC Quan	(2) CPC List Division	(3) Cog	(4) Mem	(5) Eval[b]	(6) DPC Qual
(1) CTMM Non-lang. IQ	049	067	-096	120	013	229
(2) CTMM Language IQ	007	180	259	216	253	451
(3) CTMM Total IQ	071	191	-091	201	131	403
(4) Math G P A	136	253	550	371	308	306
(5) English G P A	205	338	481	379	228	176
(6) History G P A	142	269	686	492	357	379
(7) CAT Reading Vocab.	083	314	482	518	365	461
(8) CAT Reading Comp.	023	392	612	470	355	351
(9) CAT Arith. Reas.	001	451	388	324	193	407
(10) CAT Arith. Fund.	007	522	454	437	288	321

a. Decimal points omitted.
b. Total criterion points.
Significance levels: .269 at .05; .348 at .01; .435 at .001.

Beginning with row 1, we see that no classification task devised for the research correlates significantly with Non-language IQ. The only classification score which correlates with IQ is the DPC-Qual (5 point classes) which correlate with both Language IQ (.451) and Total I.Q. (.403). Rows 7 and 8 on the table are instructive. All classification abilities except DPC-Quan correlate significantly with CAT Reading Vocabulary. The highest of these is with Memory of Classes, (.518). All classification abilities except DPC-Quan also correlate significantly with CAT Reading Comprehension. The highest of these correlations is with Cognition of Classes, (.612). The CAT Arithmetic scores, columns 9 and 10, correlate significantly with most classification scores. The highest correlations for both are with Convergent Production of Classes-List Division. Columns 5, 6, and 7 indicate that the Cognition of Classes ability correlates highest with GPA in Math (.550), in English (.481), and in History (.686).

Since Cognition of Classes correlates highest with Grade Point Average it may be instructive to compare the magnitude of these correlations with correlations between these same measures of school achievement and standardized aptitude and achievement measures. Table 7-3 presents these data on the next page.

TABLE 7-3

CORRELATIONS BETWEEN TEACHERS' GRADES AND SELECTED MEASURES

	(1)	(2)	(3)	(4)	(5)	(6)
	CTMM	California Achievement Test				
Grade Point Average	Total IQ	Reading Vocab	Reading Comp	Arith Reas	Arith Fund	Cog of classes
Mathematics	.425	.410	.574	.371	.557	.550
English	.340	.449	.432	.283	.608	.481
History	.347	.585	.618	.483	.602	.686

Comparing the correlations in column 1, with those in column 6, we find that the Cognition of Classes task devised for this study correlates higher with teachers' grades in mathematics, English and history than does I.Q. Reading across the first row in the table, we find that Cognition of Classes correlates very nearly as well with GPA in math (.550) as does Arithmetic Fundamentals (.557) and better than does Arithmetic Reasoning (.371). CAT Reading Comprehension correlates higher with Math GPA (.574) than does Arithmetic Fundamentals (.557) or Cognition of Classes (.550), but the differences are not great. Attention to teachers' grades in English is also interesting. Here we find CAT Arithmetic Fundamentals correlating higher (.608) than does Reading Vocabulary (.449) or Reading Comprehension (.432). Cognition of Classes correlates higher with English GPA (.481) than does either the Reading Vocabulary or Reading Comprehension score. Cognition of Classes correlates highest of any measure with GPA in history. Next in magnitude with history grades is Reading Comprehension (.618) followed by Arithmetic Fundamentals (.602).

These persistent correlations between teachers' grades, Reading Comprehension, Reading Vocabulary, and Cognition of Classes have led us to attempt an analysis of the Classification ability itself. It is interesting to ponder why the ability to do arithmetic computation should be related to classroom achievement in English and why, on the other hand, the ability to classify simple words about LAW should be related to achievement in math. Following is our analysis:

The Cognition of Classes tasks devised for this study presented the subject with four words, all having originally been associated to the word LAW, three of which shared a common intrinsic attribute and/or a common level of abstraction and/or a similar subordinate position to a common heading. The fourth word of the array related in one way or another to one or more of the words constituting the category, but not to all three. The task of the subject was simply to circle the word that did not belong.

In order to accomplish this task, the subject must first have attained the concepts presented by each word in the array to the extent of being aware of the relevant attributes--the attributes which served as the basis of the category built into the items. This accounts in a rough way for the importance of vocabulary or concept attainment to the classification task. Assuming that the subject has adequate concepts for the task, he must resist the temptation to respond on the basis of a hypothesis that occurs to him before the relevant attributes of all the words have come into awareness and are available for the task. Then he must engage in search behavior or hypothesis testing until he discovers the commonality that is shared by three but not by the fourth in the array.

Vocabulary or mature concepts are necessary to, but not sufficient for the classification tasks. Even if the subject has a concept which he can utilize readily in its most common context, he cannot utilize it effectively in a classification task unless he can abstract its attributes and inhibit the tendency to respond until he has matched the abstracted attributes of all words in the array and found the relevant categories. In short he must analyze--tell himself all he knows about the stimulus words and be sure he understands the nature of the problem before he proceeds.

This description of the classification task parallels in many ways the description of the behavior of the effective problem solver in math. There may be many parallels also between this process and that involved in reading comprehension--the knowledge of concepts, and the ability to resist the temptation to move ahead before one has allowed oneself to understand what one knows about the concepts and relationships being spelled out on the printed page.

To the extent that this analysis has validity, it offers some explanation for the remarkable relationships among cognition of classes, Reading Comprehension, and school achievement in math and English. In addition, it gives some support to the Structure of Intellect theory which postulates a classifying ability that operates across content boundaries and involves more than the knowledge of the units being classified. More importantly, however, the analysis suggests the possibility that classification tasks using words and meanings may serve as a vehicle for the development or improvement of an analytic approach to learning.

SUMMARY, CONCLUSIONS, AND INTERPRETATIONS

This paper describes a study designed to investigate the abilities of junior high school pupils to classify semantic information according to the operations hypothesized by the Structure of Intellect model. The study was undertaken in an attempt to gather data with which to assess, in very general terms, whether the practice of using the Structure of Intellect in the preparation of teachers both as a description of intellect and as a taxonomy of educational objectives is sound.

The soundness of the practice rests both on the practicality of expecting teachers to be able to design techniques and questions with which to elicit many different kinds of intellectual behavior and on the validity of the model as a taxonomy of educational objectives. The techniques and procedures used in this study were designed as a kind of example of how a teacher might go about eliciting classification behavior in his own classroom with his own pupils and with his own subject matter. A teacher using the techniques and procedures in connection with his own teaching would select a stimulus topic central to his own subject-matter and would design classification items relevant to concepts important to curricular goals, and he would use the student's responses for instruction rather than for measurement. The study was undertaken on the assumption that if college students can design items that successfully elicit five kinds of classification behavior from school age children under the conditions imposed by the research design, it is reasonable to assume that they could do so in a real teaching setting.

The validity of the model, as far as this study is concerned, rests with whether it is important or desirable for a teacher to call upon his students to classify. Is there, for example, something about the act of classifying that is especially relevant to the goals of education, and if so, is it worthwhile to call for classification behavior from students using several rather than only one or two operations.

We interpret the findings reported in the previous pages of this report as lending support to both premises: (1) that it is practical to expect teachers to be able to elicit classification behavior from their students; and (2) that it is desirable for them to do so.

Relevant to the practicality is the fact that, in a very brief space of time, college students designed the items utilized in this study. Items designed to stimulate classification behavior using five different operations apparently did elicit the five operations to some extent. In an effort to introduce novelty into the classification tasks a variety of items were devised. These were more time consuming to design than the relatively straight-forward tasks used my Guilford, and they were less effective. The tasks devised for the study which were easiest to design were also the most effective.

Many of the findings lend support to the desirability of calling upon students to classify. First, classification ability is related to achievement in such seemingly diverse subject matters as mathematics and history and is related, also, to vocabulary and reading comprehension. It is not possible from the nature of our findings to separate cause and effect in these relationships, but this does not lessen the importance of the fact of the relationship. Our analysis of the classification behavior of subjects in this study suggests that such tasks demand a kind of analytic behavior--thinking--which is involved in many ways in problem solving behavior in mathematics, with symbolic content, but which is much less frequently demanded with semantic material. Given a group of words or concepts to classify, the subject must pay attention to the attributes of the words--must see more than the most obvious or common characteristics of each one and then must search for commonality among them. It is of little moment to the teacher whether increasing a student's interest in words and their attributes will result in improved ability to classify or whether improved ability to classify will increase the student's interest in words. Anything that results in increased interest in concepts and their attributes will pay off handsomely for the student. This study has demonstrated many ways in which classification tasks can be used to contribute toward such a goal.

Second, the findings lend support to the use of the several operations in stimulating classifying behavior rather than relying on just one. The analysis in turn of each of the five operations has brought insights into the nature of this complex entity called intellect. For example, the classes produced by the subjects from scratch in the Divergent Production of Classes task demonstrated both the difficulty and the challenge of so seemingly simple a task. The Convergent Production of Classes items suggested that supplying cues as to the nature of the class built into the item dilutes their potential. The Memory of Classes procedure reminded us that attempts to remember something as complex as a system of classes may actually interfere with thinking behavior. The Evaluation procedure demonstrated the effects of making hurried judgments before rather than after applying the criterion on which the judgment is to be based.

In addition to learning about intellect from studying the responses produced by subjects to the various operations, the teacher can learn about the differences among students. Our study demonstrated that the correlations among four of the operations are not high, even though in all operations the product and the content were the same--semantic classes. Individual youngsters in our sample showed idiocyncratic patterns in terms of the operations--one performing especially well on Convergent Production of Classes, a second demonstrating unusual ability on Evaluation of Classes, and so forth.[1] We cannot say from this one sample of behavior whether or not such patterns would persist. If it were to be shown that they do, a teacher could readily learn how to arrange for individual youngsters to have genuine success experiences in school.

In short, many findings from this study can be interpreted as lending support to the continued use of the Structure of Intellect in the professional education of teachers both as a description of intellect and as a taxonomy of educational objectives at least for the facets of the model investigated in this research.

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[1] See Appendix, Page 76, Table 8, The Placement by Stanines of the Fifty-Four Subjects on IQ, GPA, and the Classification Tasks.

APPENDICES

Name ______________________________ **DIVERGENT PRODUCTION OF UNITS**

Instructions: On this sheet, write down all the words or ideas that come to your mind when you think of the word LAW. If an idea that comes to your mind includes the word "law", such as "law school", write both words.

Try to avoid losing contact with the topic LAW. For example, you may think of the word, "uniform" because policemen wear uniforms. You should write the word "uniform" on your paper, but if the word uniform makes you think of the word "inform" because they sound alike, don't write the word "inform", but start again with the word, "law".

Write as many words as you can in the ten minutes allowed. If you don't know how to spell a word, do the best you can, or raise your hand and we will help you with the spelling. If you still have words you want to write when we call "time", write the word "time" on your paper. If you run out of space, continue your list on the back of this sheet.

LAW

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________
11. ______________________________
12. ______________________________
13. ______________________________
14. ______________________________
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31. ______________________________
32. ______________________________
33. ______________________________
34. ______________________________
35. ______________________________
36. ______________________________
37. ______________________________
38. ______________________________

Name ________________________________ **DIVERGENT PRODUCTION OF CLASSES**

See how many different categories you can make in thirty minutes using the words you wrote about the topic, "law". Each category you think of should be written in one of the boxes below. Each category you write should have at least one word from your own list or from the list on the board, but you may use words not on the list if you need them to make good categories. You do not have to write the heading for your category, but you may do so if you wish. You may use a word in as many categories as you wish, but try to make as many different categories as you can, that is, try to have categories based on a variety of characteristics.

CONVERGENT PRODUCTION OF CLASSES - MATCHING

Complete the categories started in the boxes by picking out the word from the list at the left which best fits the other two. Write the word in the box. Use each word from the list only once. We will work the first item together, then see how many of the items you can complete in the time allowed.

ITEM 2.

LEVINWORTH

MR. RICHELIEU

PERRY MASON

STAGECOACH

ALCATRAZ SAN QUENTIN	HONEY WEST MAN FROM U.N.C.L.E.
J.EDGAR HOOVER CHIEF JUSTICE WARREN	MARSHALL DILLON WYATT EARP

ITEM 3.

ARSON

DELINQUENT

FATHER

HELMET

PRECINCT

SWITCHBLADE

BRASS KNUCKLES GUN	GLOVES SHOES	MAYOR PRINCIPAL
DISTRICT CITY	MURDER ROBBERY	JUVENILE HALL JUVENILE COURT

ITEM 4.

BURGLER ALARM

ELECTORATE

HANDCUFF

OPERATIVE

STOCKADE

SUCCESSION

PRISON JAIL	SIREN WHISTLE	ELECTION APPOINTMENT
VOTERS CONSTITUENTS	AGENT SPY	NIGHT STICK GUN

CONVERGENT PRODUCTION OF CLASSES - MATCHING

Complete the categories started in the boxes by picking out the word from the list at the left which best fits the other two. Write the word in the box. Use each word from the list only once. Complete as many as you can in the time allowed.

ITEM 5.

CHARGE

GUILTY

REASON

VINDICATE

EXONERATE ACQUIT	ACCUSE INDICT
JUSTIFY EXCUSE	INCRIMINATE CONVICT

ITEM 6.

CIVILIAN

GANGSTER

OFFICIAL

SOLDIER

DESERTION INSUBORDINATION	GRAFT CORRUPTION
TAX EVASION SPEEDING	COUNTERFEITING SMUGGLING

ITEM 7.

BRIBERY

MURDER

SLAVERY

VANDALISM

HOMOCIDE MANSLAUGHTER	ARSON BREAKING AND ENTERING
ASSAULT KIDNAP	GRAFT EMBEZZLEMENT

CONVERGENT PRODUCTION OF CLASSES - SAME WORD

Most words can be put into several different categories when we think of different ways in which they are used or when we group them with other words which share a common attribute. In the items below, a word is used to begin each of several different categories. In the sample item, #8, two words have been added to the word policeman in each column to give us a clue as to the category that has been started. Our job is to pick out from the list at the left additional words to write in each box. When we have done the sample item together, see whether you can do the same thing in items 9 and 10.

ITEM 8.

COP
CORONER
DOORMAN
NURSE
PLAINCLOTHESMAN
POSTMAN
TEACHER
TELEPHONE OPERATOR

POLICEMAN	POLICEMAN	POLICEMAN	POLICEMAN
SHERIFF	DESK SERGEANT	CITY ENGINEER	AIRLINE HOSTESS
MARSHALL	STENOGRAPHER	FIREMAN	SAILOR

ITEM 9.

BAILIFF
BIBLE
COURT
COURT REPORTER
DECIDE
DEFENDENT
DELIBERATE
EYE WITNESS
JURY BOX
MAGISTRATE
WEIGH
WITNESS STAND

JUDGE	JUDGE	JUDGE	JUDGE
FLAG	JURY	EVALUATE	HIS HONOR

ITEM 10.

AUTHORIZE
COMMAND
CONTROL
DELEGATED
ENTITLED
KING
KNOWLEDGE
PRESIDENT
PROFESSOR
SPECIALIST
VESTED

AUTHORITY	AUTHORITY	AUTHORITY
EXPERT	POWER	PERMISSION

CONVERGENT PRODUCTION OF CLASSES - LIST DIVISION

Divide the list at the left into two categories by writing the words in the appropriate box. We will work the first one together, then see how many of the items you can complete in the time allowed.

ITEM 12.

ASSEMBLY
BROWN
CONGRESS
JOHNSON
LEGAL VOTING AGE
MEDICARE
SACRAMENTO
WASHINGTON D.C.

Category I

Category II

ITEM 13.

CLUE
SUMMONS
FINGERPRINT
INTEROGATE
WARRANT
TICKET
LIE DETECTOR
SUBPOENA

Category I

Category II

ITEM 14.

ARRESTED
BAIL
BOOKED
CONVICTED
IMPRISONED
PARDONED
PAROLED
PROBATION

Category I

Category II

CONVERGENT PRODUCTION OF CLASSES - LIST DIVISION

Divide the list at the left into three categories by writing the words in the appropriate box.

ITEM 15.

CRIMINAL
CROOK
COURT MARTIAL
DEPUTY
FUGITIVE
HEARING
MARSHALL
POLICEMAN
TRIAL

Category I	Category II	Category III

ITEM 16.

WARDEN
ATTORNEY
COUNSELOR
D.A.
FATHER
GOD
GUARD
JAILER
KEEPER
LAWYER
MAYOR
PRESIDENT

Category I	Category II	Category III

ITEM 17.

"C" CARD
DRAFTED
ENTITLED
FINE
IMPRISONED
LICENSE
ORDERED
PASSPORT
PERMITTED
PUNISHED
SUBPOENA
SUMMONS

Category I	Category II	Category III

CONVERGENT PRODUCTION OF CLASSES - CROSS WORD

The three items below are like cross word puzzles in which you work with meanings of words rather than with letters. The words at the left can be written in the boxes so that the words in each row form categories and the words in each column form different categories. In this way we can make six categories from the nine words. We will work the first one together. When you understand how it is done, see if you can work out the other two puzzles by figuring out which word to write in each box.

ITEM 18.

DEMOCRACY
DICTATORSHIP
LONDON
MONARCHY
MOSCOW
PREMIER
PRESIDENT
QUEEN
WASHINGTON D.C.

ITEM 19.

ARMED FORCES
HIGHWAY PATROL
HORSE
JEEP
MILITARY POLICE
MOTCRCYCLE
MOUNTED POLICE
NATION
STATE

ITEM 20.

EXECUTIVE
ENFORCE LAWS
CONGRESS
JUDICIAL
HEAR CASES
LEGISLATIVE
PASS LAWS
PRESIDENT
SUPREME COURT

MEMORY OF CLASSES

ITEM 11. We will work this item together. Pick out from among the words in the list the five words which you think will make the best headings under which to categorize other words in the list. Write each heading-word you decide on at the top of one of the squares below. Now, write each of the other words from the list in the square with the appropriate heading. Use each word only once.

ARREST
ATTORNEY
CONGRESS
CORRECTION
COURT
DETECTION
ENFORCEMENT
FINE
FINGERPRINT
GUN
HIGHWAY PATROL
INVESTIGATOR
JUDGE

JUDICIAL SYSTEM
LEGISLATION
LIE DETECTOR
MEDICARE
POLICEMAN
PAROLE
PRISON
PROBATION
SENATOR
STATUTE
SURVEILANCE
TRIAL

COGNITION OF CLASSES DELETION

NAME ________________________

EXAMPLE:
JAIL
MURDER
PRISON
STOCKADE

INSTRUCTIONS: You are to make the best possible category or class of words by removing the one word you consider inappropriate from each item. Circle the one word in each item that does not belong.

(1) AMBULANCE
GET-AWAY CAR
MOTORCYCLE
SQUAD CAR

(2) OUTLAW
BANDIT
IN-LAW
CRIMINAL

(3) BILLYCLUB
BLACK-JACK
PISTOL
WHISTLE

(4) KING
PEOPLE
PRESIDENT
PRINCIPAL

(5) DETECTIVE
F.B.I.
LAWYER
POLICEMAN

(6) BILL OF RIGHTS
CONSTITUTION
LINCOLN
EMANCIPATION-PROCLAMATION

(7) ARREST
FINGERPRINT
INTERROGATE
LIE DETECTOR

(8) CONGRESS
GOVERNOR
PRESIDENT
SUPREME COURT

(9) DEFENDENT
DISTRICT ATTORNEY
JUDGE
POLICEMAN

(10) DEPUTY
HIGHWAY PATROLMAN
MARSHALL
SHERIFF

(11) IMPRISONMENT
FINE
GALLOWS
ELECTRIC CHAIR

(12) MURDER
RIOT
ROBBERY
SHOPLIFTING

(13) MARSHALL
POLICEMAN
JUDGE
DEPUTY

(14) ABIDE BY
LAWS
ORDERS
RULES

(15) OPERATIVE
SECRET AGENT
SPY
ELLIOT NESS

(16) HONEST
LEGAL
OBEY
LEGITIMATE

(17) AMENDMENT
BILL OF RIGHTS
LAW
STATUTE

(18) CONGRESSMAN
JUDGE
REPRESENTATIVE
SENATOR

(19) JUDGE
JURY
LAWYER
MAYOR

(20) BADGE
BILLYCLUB
GUN
TEAR GAS

(21) CHIEF JUSTICE
CHIEF OF POLICE
JUDGE
JUSTICE OF THE PEACE

(22) BEATNIK
KIDNAPPER
PICKPOCKET
VANDAL

(23) JAIL
CELL
PRISON
PENITENTIARY

(24) GOVERN
JUDGE
REIGN
RULE

(25) CROSSWALK
JAYWALK
STOP SIGN
TRAFFIC LIGHT

(26) SENATE
VICE PRESIDENT
GOVERNMENT
CONGRESS

(27) RADIO
SIREN
SPOTLIGHT
STOP SIGN

COGNITION OF CLASSES -- PICK - A - HEADING

In each item there are four words. See if you can pick out one word which makes the best heading for the category formed by the remaining three words. Circle the word you have chosen as the best "heading-word".

PICK - A - HEADING

1. BADGE
BOOTS
HELMET
UNIFORM

2. JOHNSON
LINCOLN
PRESIDENT
WASHINGTON

3. CAPITAL CRIME
KIDNAPPING
MURDER
TREASON

4. DEFENDENT
JUDGE
JURY
TRIAL

5. CROSSWALK
SPEED LIMIT
STOP LIGHT
TRAFFIC LAWS

6. FINE
HARD LABOR
PRISON
PUNISHMENT

7. BULL
COP
FUZZ
POLICEMAN

8. EXECUTIVE
PRESIDENT
SECRETARY OF DEFENSE
VICE PRESIDENT

9. PICKING POCKETS
ROBBERY
SPEEDING
UNLAWFUL

10. BANK ROBBER
CRIMINAL
MURDERER
THIEF

11. LYNCH MOB
SHERIFF
STAGECOACH
WESTERNS

12. CASE
EVIDENCE
TRIAL
VERDICT

13. BOBBY
BRITAIN
PARLIAMENT
PRIME MINISTER

14. CONGRESSMAN
ELECTED
MAYOR
PRESIDENT

15. JUVENILE COURT
JUVENILE DELINQUENT
JUVENILE HALL
REFORM SCHOOL

16. ELECTROCUTE
EXECUTE
GAS
HANG

17. F.B.I.
SUPREME COURT
WHITE HOUSE
WASHINGTON D.C.

18. ASSEMBLYMAN
LEGISLATOR
REPRESENTATIVE
SENATOR

19. LOCKS
PREVENTION
SIGNS
STOP LIGHTS

20. ACCUSED
CHARGED
DEFENDENT
SUSPECT

COGNITION OF CLASSES

(28) INDICTMENT
SUMMONS
TICKET
WARRANT

(29) KING
LORD
PRIME MINISTER
SENATOR

(30) GRAND THEFT
PICKPOCKET
SHOPLIFTING
VANDALISM

(31) CHIEF JUSTICE
JUDICIAL BRANCH
JUDGE
JUSTICE OF THE PEACE

(32) CASE
COURT
HEARING
TRIAL

(33) GOVERNOR
CHIEF JUSTICE
MAJOR
PRESIDENT

(34) INTERPRETATION
LAW
RULE
STATUTE

(35) APPOINT
ELECT
POWER
SEIZE

(36) ENFORCE
INTERPRET
LEGISLATE
ORDER

(37) CAPITOL
KREMLIN
MT. VERNON
WHITE HOUSE

(38) EXECUTIVE
GOVERNMENT
JUDICIAL
LEGISLATIVE

(39) CRIME
INVESTIGATION
PREVENTION
PUNISHMENT

(40) POLICEMAN
PRINCIPAL
SUPERINTENDENT
TEACHER

(41) HIGHWAY PATROLMAN
PLAINCLOTHESMAN
POLICEMAN
PRIVATE DETECTIVE

(42) CROOK
ROBBER
STEAL
THIEF

(43) REGULATIONS
RIGHTS
RULES
RESTRICTIONS

(44) ANARCHY
DEMOCRACY
COMMUNISM
TYRANNY

(45) CHIEF OF POLICE
FIRE CHIEF
GOVERNOR
MAYOR

(46) ALIBI
FALSIFY
LIE
PERJURY

(47) EX-CONVICT
FUGITIVE
PAROLEE
PRISONER

(48) FREEDOM
GOVERNMENT
JUSTICE
LIBERTY

(49) IDEA
PRINCIPLE
THEORY
VERDICT

(50) GRAVITATIONAL LAW
CONSTITUTIONAL LAW
NATURAL LAW
SCIENTIFIC LAW

(51) AGAINST THE LAW
ILLEGAL
SINFUL
UNLAWFUL

(52) COURT FEES
FINE
RANSOM
TICKET

(53) DISHONEST
DISLOYAL
ILLEGAL
UNTRUTHFUL

(54) ABIDE BY
OBEY
RULE
UPHOLD

(55) DELIBERATE
EXAMINE
HEAR
VERDICT

(56) SPEED LIMIT
STOP SIGN
TICKET
TRAFFIC LIGHT

(57) ELECT
APPOINT
IMPEACH
SUCCEED

(58) CONSTITUENTS
ELECTORATE
NOMINEE
VOTERS

(59) ACCUSATION
SUMMONS
SUBPOENA
WARRANT

(60) AWARD
DELIBERATE
JUDGMENT
SENTENCE

EVALUATION OF CLASSES

INSTRUCTIONS: In these items, three words that form a category have been grouped together. To the right of each category there are two other words, marked (A) and (B). Your task is to decide which of these two alternatives fits best with the other three words in the categoty. When you have decided, tell the interviewer. He will mark your answer sheet and will write down your reason for picking the word you did.

EXAMPLE

	A DOZEN EGGS A RULER A YEAR	(A) A JUDGE (B) A JURY
1.	LAWYER JUDGE BAILIFF	(A) COURT REPORTER (B) JURY BOX
2.	GUN KNIFE SWITCHBLADE	(A) BILLYCLUB (B) BRASS KNUCKLES
3.	PRESIDENT PRIME MINISTER PREMIER	(A) SENATOR (B) KING
4.	CITY HALL POLICE STATION FIRE STATION	(A) STATE CAPITOL (B) COURTHOUSE
5.	JUSTICE PEACE LIBERTY	(A) TRUTH (B) FREEDOM OF SPEECH
6.	PRESIDENT SENATOR CHIEF JUSTICE	(A) SECRETARY OF DEFENSE (B) MAYOR
7.	TRAFFIC COURT DIVORCE COURT SMALL CLAIMS COURT	(A) JUVENILE COURT (B) SUPREME COURT
8.	INMATE PRISONER WARDEN	(A) CONVICT (B) PAROLEE
9.	CELLS BARS ELECTRIC FENCE	(A) GAS CHAMBER (B) WALLS
10.	SUPREME COURT COUNTY COURT NIGHT COURT	(A) TRAFFIC COURT (B) KANGAROO COURT
11.	GAVEL ROBE JURY BOX	(A) BAILIFF (B) BIBLE
12.	BILL OF RIGHTS FEDERAL LAW 21st AMENDMENT	(A)CONSTITUTION (B) ORDINANCE
13.	SUMMONS TICKET WARRANT	(A) INDICTMENT (B) SUBPOENA
14.	HANDCUFF WHISTLE HOLSTER	(A) UNIFORM (B) BILLYCLUB
15.	KILLING MURDER ASSASSINATE	(A) HOMOCIDE (B) GRAND LARCENY
16.	GUARDIAN COUNSELOR PARENT	(A) TEACHER (B) SUPERINTENDENT
17.	DETECTIVE PRIVATE EYE INSPECTOR	(A) INVESTIGATOR (B) POLICEMAN
18.	SENATE ASSEMBLY SUPERVISORS	(A) HOUSE OF REPRESENTATIVES (B) SUPREME COURT
19.	JUVENILE MINOR CHILD	(A) DELINQUENT (B) ADOLESCENT
20.	LAW STATUTE ORDINANCE	(A) BILL (B) LEGISLATE
21.	ELECTRIC CHAIR GAS CHAMBER FIRING SQUAD	(A) LYNCH (B) GALLOWS
22.	LYNCH MOB VIGILANTES KU KLUX KLAN	(A) COURT MARTIAL (B) KANGAROO COURT

EVALUATION OF CLASSES

23. BURGLAR (A) SHOP LIFTER
THIEF (B) VAGRANT
PICKPOCKET

24. BAIL (A) ATTORNEY'S FEES
COURT COSTS (B) JUDGE'S FEES
FINE

25. COURT REPORTER (A) TRANSCRIPT
STENOGRAPHER (B) TAPE RECORDER
SECRETARY

26. MOUTHPIECE (A) DEFENSE ATTORNEY
COUNSELOR (B) PROSECUTING ATTORNEY
SOLICITOR

27. DESERTER (A) WET BACK
FUGITIVE (B) PRISONER
OUTLAW

28. HOMOCIDE (A) MISSING PERSONS
TRAFFIC (B) DEATH PENALTY
NARCOTICS

29. STOP LIGHT (A) TRAFFIC POLICE
TRAFFIC SIGNS (B) SPEEDING
DOUBLE YELLOW LINE

30. SUSPENDED (A) ARRESTED
REVOKED (B) LOST
EXPIRED

31. TRUANT (A) MINOR
SAFETY PATROL (B) DELINQUENT
CURFEW

32. ACCUSE (A) LIE
SLANDER (B) STEAL
CHARGE

33. PARDON (A) OUT ON BAIL
PAROLE (B) SUSPENDED SENTENCE
PROBATION

34. BOOKED (A) CONVICTED
ARRESTED (B) ACCUSED
INDICTED

35. DEFENDENT (A) PRISONER
ACCUSED (B) PLAINTIFF
SUSPECT

36. ACCUSATION (A) CHARGE
INDICTMENT (B) SUSPICION
ALLEGATION

37. DEFEND (A) PROSECUTE
CROSS EXAMINE (B) TESTIFY
QUESTION

38. MANSLAUGHTER (A) SUICIDE
ACCIDENTAL DEATH (B) MURDER
JUSTIFIABLE HOMOCIDE

39. FLAG
LIBERTY BELL (A) UNCLE SAM
EAGLE (B) PLEDGE OF ALLEGIANCE

40. LOITERING (A) OVER-PARKING
VAGRANCY (B) SPEEDING
DISTURBING THE PEACE

41. REBELLION (A) PANIC
INSURRECTION (B) RIOT
REVOLUTION

42. DEMOCRACY (A) ANARCHY
MONARCHY (B) DESPOTISM
DICTATORSHIP

43. WARNING (A) DIRECTIONS
REPRIMAND (B) CRIME
CITATION

44. BENCH (A) JUDGE
HIS HONOR (B) JURY
COURT

45. EYE WITNESS (A) POLICE
VICTIM (B) SUSPECT
BYSTANDER

46. ACQUIT (A) INDICT
CONVICT (B) ESCAPE
DISMISS

47. FREEDOM OF SPEECH (A) THE RIGHT TO BEAR ARMS
FREEDOM OF RELIGION (B) FREEDOM FROM FEAR
FREEDOM OF ASSEMBLY

48. SOLITARY CONFINEMENT (A) PRISON
BREAD AND WATER (B) CHAIN GANG
HARD LABOR

49. LAW OF GRAVITY (A) LAW OF THE LAND
LAW OF GOD (B) LAW OF NATURE
LAW OF SUPPLY AND DEMAND

50. PROPERTY DAMAGE (A) STEALING A CAR
DIVORCE (B) ACCIDENTAL INJURY TO A PASSENGER IN YOUR CAR
NON-PAYMENT OF DEBTS

ANSWER SHEET FOR EVALUATION OF CLASSES

Subject's Name ______________________ **Interviewer's Name** ______________________

Item No.	Answer A or B	Rationale

DIVERGENT PRODUCTION OF UNITS SCORING MANUAL

TEGORY	SCORE		SUB-CATEGORY	SCORE		EXAMPLES
	N	Q		N	Q	
I. High level abstractions.						Human conditions dependent upon law. democracy, justice, truth, freedom, equality, duty, independence, peace, safety, security, authority, life, government
II. Forms, definitions, purposes			A.			Abstract terms indicating what laws pertain to: statutes, rules, principles, regulations, orders, requirements, restrictions, prohibitions, obligations, duties, safe-guards, protection, privileges, rights, guides, governmental rules, codes
			B.			Abstract terms indicating a positive relationship between individual and the law: defend, abide by, follow, law abiding, lawful, legitimate, defend, observe, help, agreeable, honest, need for law, loyal, laws that I have, right
			C.			Abstract terms indicating a negative relationship between individual and the law: bad, break, crime, criminal, disobey, discipline, lie, punishment, trouble, violation, wrong, against, dislike, hurt, harm, illegal, injury, mean, meanness, not nice, offenses, terrible, unhappy, unagreeable, unjust, unlawful, can't do, won't allow, treat us like babies, outlaw, convict, fugitive, delinquent
II. Enumeration of legal documents or specific laws			A.			Man-made - general Constitution, amendments, Bill of Rights, state laws, law of the land, federal law, U.S. law, county, town, city law, communities, school rules, maritime law, Articles of Confederation, preamble, misdemeanor, nations, states, people
			B.			Natural, divine, or scientific law of force, learning laws, Golden Rule, religion, church, supreme law, science, mathematics, gravity
			C.			Target groups or activities labor union laws, leash laws, transportation laws, right to vote, driving laws, tariff, divorce, taxes, business, children, old people, poor, child labor, women, young people, alcohol, license, voting, Americans, people, students
			D.			Crime and criminals indicating a knowledge of what is illegal robbery, killing, steal, riot, murder, kidnap, speeding, hold-up, mob, smuggler, thief, treason, contributing to the delinquency of a minor, assault, battery, bandit, breaking into houses, burglery, drunkeness, hit and run, helping foreign agents, leaving country without passport, manslaughter, rob a bank, slander, stow-away, knife, heroin
			E.			Laws and regulations concerning youthful offenders and offenses- cheating, be in by 12, bicycle, curfew, crashing parties, can't drive until 16, can't stand in corridors, ditching, don't write on desks, dog on school grounds

TEGORY	SCORE	SUB- CATEGORY	SCORE	DEFINITIONS AND EXAMPLES
IV. Pertaining to legislation				Congress, legislative, representative, senate, law making, bill, senator, house, house of representatives, council, congressman, election, how a bill becomes a law, politics, party, republican, running, city hall, capitol
V. Pertaining to government.		A.		Executive branch and seats of power. United States: president, executive, cabinet, capitol, governor, vice president, mayor, state department, Washington D.C., White House
		B.		Presidents by name: Kennedy, Johnson, Truman, Lincoln
		C.		Free associations: Gettysburg Address, Arlington Cemetery, Tomb of the Unknown Soldier
		D.		Other forms of government: Communism, dictatorship, ruler, Musolini, Hitler, Panzer Division, Rommel, Third Reich
		E.		War - Defense Department and Armed Forces war, Viet Nam, Coast Guard, marine police, Pentagon, Shore Patrol, Commander in Chief of the Armed Forces, General, George Patton, Pearl Harbor
		F.		Non-governmental persons in authority father, mother, principal, teacher, and specified persons
VI. Pertaining to enforcement.		A.		Abstractions: enforcement, enforce, detection, correction, apprehension, investigation, confinement, penalities
		B.		Institutions: police force, police department, juvenile hall, highway patrol, F.B.I., Scotland Yard, traffic court, police station, C.I.A.
		C.		Officers: police, policeman, sheriff, detectives, deputies, officer, reinforcements, cop, marshall, sergeant, fuzz, Elliot Ness, J.Edgar Hoover, juvenile authorities, patrol, lieutenant, probation officer, Sherlock Holmes, investigator, agent
		D.		Equipment: uniform, gun, siren, badge, car, motorcycle, police car, signs, stop sign, ambulance, handcuff, police dog, lights, radar, radio, signal, telephone, billy-club, lie detector, police hat, stop light, tape recorder
		E.		Processes: ticket, arrest, bail, chase, fingerprint, booked, captured, citation, license number, road block, summons, shoot, clues
		F.		Correction and penalities: jail, prison, fine, electric chair, gas chamber, probation, bars, cells, death, death penalty, hang, hard labor, San Quentin, warden, jail break, convict, ex-convict, fugitive

CATEGORY	SCORE	SUB-CATEGORY	SCORE	DEFINITIONS AND EXAMPLES
VII. Pertaining to judicial system.				
		A.		Abstractions: justice, judicial, interpretation, bench, interpret, jurisdiction
		B.		People: judge, jury, lawyer, witness, attorney, defendent, accused, Perry Mason, prosecutor, defense attorney, Chief Justice, counselor, client, district attorney, justice of the peace, supreme justice, spectators, bailiff
		C.		Processes: trial, defend, decision, subpoena, case, defense, oath, sue, testify, question, evidence
		D.		Institutions: court, Supreme Court, Court of Appeals, District Court, Traffic Court, courtroom, court house
		E.		Verdict: verdict, convict, conviction, guilty, not guilty, innocent, sentence
VIII. Pertaining to law as a profession.				
		A.		Abstractions: field of law, profession
		B.		Specific: lawyer, attorney, law practice, law book, law suit, law school, books, case, client, classes, college, college years, Harvard, Yale, law firm, law office, law study, law academy, legal secretary, learning, office, private school, sue, study, understanding the law
		C.		Miscellaneous: teacher, doctor
IX. Other.				money, accident

TABLE 8

THE PLACEMENT BY STANINES OF THE FIFTY-FOUR SUBJECTS ON IQ, GRADE POINT AVERAGE AND SIX TASKS DESIGNED FOR THE STUDY

ID#	SEX	(1) TIQ	(2) GPA	(3) DPU	(4) DPC	(5) CPC	(6) MEM	(7) COG	(8) EVAL
10	Y	1	3	6	4	3	4	4	6
12	X	5	6	5	6	5	4	5	6
13	X	2	9	9	7	7	5	6	5
14	Y	6	4	3	4	5	4	3	5
15	Y	5	5	3	3	2	5	5	4
16	X	6	3	4	7	4	6	4	4
17	X	6	4	4	6	3	2	5	2
18	Y	3	4	4	1	2	7	5	3
19	X	8	6	4	4	9	4	5	8
20	X	3	4	2	1	4	4	7	5
21	X	3	3	5	4	6	5	3	3
22	X	3	2	2	2	6	3	2	1
23	X	5	7	4	5	4	7	8	7
24	Y	6	5	8	6	7	7	4	3
25	Y	6	6	8	3	6	6	7	8
26	Y	6	3	3	5	1	3	2	5
27	Y	7	5	6	5	4	7	5	3
28	X	6	6	6	4	8	6	6	5
29	X	2	2	7	6	8	4	2	5
30	Y	7	2	4	3	4	7	8	6
31	X	9	4	7	5	6	5	6	2
33	X	4	3	5	7	2	5	4	4
34	X	2	4	1	2	5	5	1	3
35	X	2	7	7	8	3	6	4	4
36	X	4	8	3	5	7	4	8	4
37	X	7	7	6	8	5	5	5	6
38	X	6	6	5	5	3	3	2	6
39	X	5	6	3	3	5	5	6	6
40	Y	5	7	5	4	9	6	6	6
41	Y	4	6	5	4	2	4	1	6
42	Y	8	5	2	6	8	8	7	4
43	Y	9	9	6	4	8	9	9	9
44	Y	7	8	8	6	7	7	7	5
45	X	4	4	5	6	6	2	4	7
46	X	4	5	6	8	2	4	5	5
47	X	4	1	3	2	5	1	3	2
48	Y	3	1	4	4	4	2	6	7
49	X	4	6	5	6	5	2	4	1
51	Y	7	7	6	7	6	1	8	7
52	Y	5	4	3	4	3	4	7	7
53	X	5	5	5	6	1	6	3	2
54	Y	9	8	7	7	7	8	6	6
55	Y	8	8	5	7	4	7	7	4
56	Y	7	6	5	3	7	9	6	8
58	Y	4	3	1	4	5	3	4	3
59	X	3	5	5	4	4	8	7	7
60	X	1	5	4	2	3	7	5	3
61	Y	7	6	7	3	6	5	3	5
63	Y	5	3	6	6	5	7	3	6
65	X	3	7	6	7	4	7	7	4
67	Y	7	2	8	9	4	3	2	4
69	Y	5	5	7	9	6	4	5	4
71	X	5	5	9	8	6	7	6	8
73	Y	4	4	2	3	6	4	5	8

(1) CTMM IQ

(2) Grade Point Average

(3) Divergent Production of Units
Total Number of Words

(4) Divergent Production of Classes
Number of Classes

(5) Convergent Production of Classes
List Division

(6) Memory of Classes

(7) Cognition of Classes

(8) Evaluation of Classes